A CACTUS GROVE, ARIZONA (SPECIES - CEREUS GIGANTEUS.)

1871.

ENGINEER DEPARTMENT, U. S. ARMY.

REPORT

UPON

UNITED STATES GEOGRAPHICAL SURVEYS

WEST OF THE ONE HUNDREDTH MERIDIAN,

IN CHARGE OF

FIRST LIEUT. GEO. M. WHEELER,

CORPS OF ENGINEERS, U. S. ARMY,

UNDER THE DIRECTION OF

BRIG. GEN. A. A. HUMPHREYS,

CHIEF OF ENGINEERS, U. S. ARMY.

PUBLISHED BY AUTHORITY OF THE HONORABLE THE SECRETARY OF WAR,

IN ACCORDANCE WITH ACTS OF CONGRESS OF JUNE 23, 1874, AND FEBRUARY 15, 1875.

IN SEVEN VOLUMES, ACCOMPANIED BY ONE TOPOGRAPHICAL AND ONE GEOLOGICAL ATLAS.

VOL. VI.—BOTANY.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1878.

[First appeared May, 1879, fide Maxon, Proc. U.S. Nat. Mus. 23:622. 1901.]

FORTY-THIRD CONGRESS, FIRST SESSION.

CHAPTER 455.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, eighteen hundred and seventy-five, namely:

* * * * * * * *

For engraving and printing the plates illustrating the report of the geographical and geological explorations and surveys west of the one hundredth meridian, to be published in quarto form, the printing and binding to be done at the Government Printing-Office, twenty-five thousand thousand.

* * * * * * * *

Approved June 23, 1874.

FORTY-THIRD CONGRESS, SECOND SESSION.

CHAPTER 76.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act entitled "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and seventy-five, and for other purposes," approved June twenty-third, eighteen hundred and seventy-four, be, and the same is hereby, amended by adding to the clause of said act relating to the engraving and printing of the plates illustrating the report of the geographical and geological explorations and surveys west of the one hundredth meridian, the following words: and "that two thousand copies of the report shall be printed by the Congressional Printer," after substituting the word "dollars" in lieu of the concluding word of said clause.

Approved February 15, 1875.

FORTY-FOURTH CONGRESS, FIRST SESSION.

"Mr. VANCE, of Ohio, from the Committee on Printing, reported the following resolution; which was read, considered, and adopted:

"*Resolved by the House of Representatives, (the Senate concurring,)* That the following distribution shall be made of the reports of the United States geographical surveys west of the one hundredth meridian, published in accordance with acts approved June 23, 1874, and February 15, 1875, as the several volumes are issued from the Government Printing-Office, to wit: Nine hundred and fifty copies of each to the House of Representatives, two hundred and fifty copies of each to the Senate, and eight hundred copies of each to the War Department for its uses."

March 29, 1876. (See Congressional Record, vol. 4, part 3, p. 2037.)

Agreed to by the Senate May 4, 1876. (See Congressional Record, vol. 4, part 3, p. 2969.)

NOTE.

Seven volumes, accompanied by one Topographical and one Geological Atlas, embrace reports upon Geographical Surveys of the territory of the United States West of the One hundredth Meridian of longitude from Greenwich, as follows:

Volume I.—Geographical Report.
Volume II.—Astronomy and Barometric Hypsometry.
Volume III.—Geology and Mineralogy.
Volume IV.—Paleontology.
Volume V.—Zoölogy.
Volume VI.—Botany.
Volume VII.—Archæology.

The Topographical Atlas edition, consisting of Title-Page, Legend, and Conventional Sign Sheets, Index, Progress and Basin Maps, and Sheets Nos. 49, 50, 58, 59, 66, 67, 75, 76, 83, 53 (C), 61 (B), 61 (C), 61 (C_1), 61 (D), 62 (A), 62 (C), 65 (D), 69 (B), 69 (D), 70 (A), 70 (C), and 77 (B) have been issued at date of sending forward the MS. of this volume. Other sheets, of which there are twenty-seven in various stages of completion, will follow as rapidly as they can be prepared, engraved, and printed.

Sheets 53 (C), 61 (B), 61 (C), 61 (D), 62 (A), 62 (C), 65 (D), 69 (B), 69 (D), 70 (A), 70 (C), and 77 (B) are projected upon a scale of 1 inch to 4 miles, while the scale of 1 inch to 2 miles has been used for sheet 61 (C_1), the latter embracing a part of the San Juan mining region of Southwestern Colorado. The scale of 1 inch to 1 mile has been selected for the six-sheet map of the lake region of the Sierra Nevada encircling Lake Tahoe; and the contour map of the Washoe Mining District, in which

is situated the famous Comstock Lode, drawn to a scale of 1 inch to 500 feet, will be published to the scale of 1 inch to 1,500 feet, making a map of the size of four regular atlas sheets.

The following Geological Maps, forming a part of those supplementing Volume III, based upon the topographical sheets, have been published, *i. e.*, Title-Page, Index Sheet, Restored Outline of Lake Bonneville, Nos. 50, 59, ½ of 58, and ½ of 66, 67, 75, 76, and 83. Other sheets are in course of completion.

The Topographical Atlas referred to, embracing the entire area west of the 100th meridian, will comprise 95 sheets, on a scale of 1 inch to 8 miles, numbered consecutively from 1 to 95, inclusive, while the "Geological Atlas" will consist of the same number, using the topographical maps as a base. (See Progress Map of 1878.) Upon a number of the topographical maps as a base, the classification of lands into the following divisions, (1) Agricultural with irrigation, (2) Timber, (3) Grazing, (4) Arid and Barren, is shown by colors. It is intended to expand this classification to embrace the entire area, thus gathering data upon which a new legal subdivision to settlers, to accord with presumable values as to class, may be made, pursuant finally to the following divisions:

1. Agricultural, { without irrigation. / with irrigation or drainage.
2. Timber, { 1. Large, / 2. Small, } with prevailing species, as Live Oak, Cedar, etc.
3. Grazing, { 1. Good, / 2. Bad, } with species and quality of grasses.
4. Arid or barren, including "desert lands."
5. Swamp and overflowed.
6. Location of the precious and economic minerals, such as—

1. Gold, in place or placer.
2. Silver.
3. Cinnabar.
4. Copper.
5. Lead.
6. Iron.
7. Coal.
8. Tin and nickel.
9. Antimony and arsenic.
10. Sulphur.
11. Sodium, chloride and carbonate of.
12. Alum and borates.
13. Peats, marls, and clays.

Each full atlas sheet represents two degrees and forty-five minutes in longitude and one degree and forty minutes in latitude (an area of from 17,000 to 18,000 square miles, or an average of 11,200,000 acres), and is so constructed, upon a special projection, as to admit that the several sheets may be joined to comprise entire political or other divisions.

The plan for the systematic prosecution of a detailed topographical survey of the territory of the United States west of the one hundredth meridian, as the main object, was submitted to the Engineer Department by the officer in charge shortly after the return of the Expedition of 1871, was then approved by Brig. Gen. A A. Humphreys, Chief of Engineers, and the Honorable the Secretary of War, and received the sanction of Congress by a specific act approved June 10, 1872.

In addition to the astronomic, geodetic, topographical, and meteorological observations needed for the preparation and construction of the map, such observations as are required, and are commensurate with the present condition of development of this region, are made in the branches of mineralogy and mining, geology, paleontology, zoölogy, botany, archæology, ethnology, and philology.

The quarto reports embrace the results of the special branches of the Survey that are completed at the date at which each is separately submitted, while annual reports of operations of the work, accompanied by maps, showing progress during the fiscal year, are regularly submitted to the Chief of Engineers, and appear as appendixes to his Annual Reports

From the accumulation of field data, the finished topographical maps are completed as fast as the draughting force permits, and with the necessary additions, special editions showing geological formations and land classification, are issued from time to time. Neither atlas will be complete until the whole work is finished.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN, FIRST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

REPORTS

UPON

THE BOTANICAL COLLECTIONS MADE IN PORTIONS OF NEVADA, UTAH, CALIFORNIA, COLORADO, NEW MEXICO, AND ARIZONA,

DURING

THE YEARS 1871, 1872, 1873, 1874, AND 1875.

BY

J. T. ROTHROCK,

LATE A. A. SURGEON, U. S. ARMY,

SURGEON AND BOTANIST TO THE EXPEDITIONS OF 1873, 1874, AND 1875, AND NOW PROFESSOR OF BOTANY IN THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PA.;

AND THE FOLLOWING SCIENTISTS:

SERENO WATSON, Cambridge, Mass.
GEORGE ENGELMANN, M. D., St. Louis, Mo.
Prof. THOS. C. PORTER, Easton, Penn.
M. S. BEBB, Fountaindale, Ill.
WILLIAM BOOTT, Boston, Mass.
GEORGE VASEY, M. D., Agricultural Department, Washington, D. C.
Prof. D. C. EATON, Yale College, New Haven, Conn.
THOS. P. JAMES, Cambridge, Mass.
Prof. EDWARD TUCKERMAN, Amherst, Mass.

IN FOUR CHAPTERS AND AN APPENDIX.

ILLUSTRATED BY THIRTY PLATES AND ONE WOODCUT.

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UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE
ONE HUNDREDTH MERIDIAN,
Washington, D. C., May 10, 1878.

GENERAL: I have the honor to submit herewith reports that go to make up Volume VI of those authorized to be published by acts of Congress approved June 23, 1874, and February 15, 1875.

The volume comprises a number of reports upon collections of the years 1871 to 1876, inclusive, made by Dr. J. T. Rothrock, surgeon and botanist to the Expeditions of 1873–4–5, and by eminent specialists.

The collections obtained during the several years, after their identification and classification, have been forwarded, through the Smithsonian Institution, for final lodgment in the herbarium of the Agricultural Department.

The following gentlemen have been engaged as field assistants in this branch, viz: Dr. W. J. Hoffman and Ferdinand Bischoff in 1871, Dr. H. C. Yarrow and H. W. Henshaw in 1872, John Wolf in 1873, Dr. J. T. Rothrock in 1873–4–5, with Messrs. J. M. Rutter in 1874 and C. Shoemaker in 1875 as sub-assistants, and in 1874–5–6 Dr. Oscar Loew.

Other members of the Expedition have also contributed to the large aggregate of specimens.

By dint of much pains and labor a number of species new to botanical science have been discovered, twenty-seven of which are here figured for the first time, as well as ten species rare, but not hitherto unknown. The total number of new species is fifty, and two distinct genera have been added to the known Flora of this portion of the United States New and well-marked varieties of older species have been obtained, and among them a number hitherto scantily represented in the largest herbaria. In many

cases a wider geographical range of known forms has been developed, as, for instance, the discovery, in Arizona, of *Ophioglossum vulgatum;* and also a number of rare species, as of the striking leafless tree of Arizona, the *Canotia,* and specimens of which are thus added to the Government and other herbaria. From the Agave plants a number are described as of value for cordage and textile fabrics. The economic relations of various forage-plants, native and introduced, are noted. The value of Chia (*Salvia Columbariæ*) as a remedy and dietetic is defined, as well as the medicinal qualities of other plants. The present and prospective relations of the forests to the settlement of the country receive mention, and tables prepared by Dr. Loew of soil analyses at important points are introduced.

Although investigations in Botany, governed in a measure by the sparsely settled condition of the regions visited, are but incidental to the systematic purpose of the Survey, which has for its main object the determination of data necessary for the construction of a detailed topographical map, yet it is believed that the material here presented, as the result of examination, by specialists, of large and complete collections, will have its value as a substantial contribution to the knowledge of the Botany of portions of the United States west of the 100th meridian and south of the 40th parallel.

Attention is invited to the authors of various parts of this report, whose names appear on the title-page, and to whom so much is due for the skill with which they have prepared their several portions, and a merited tribute to the value of their services is hereby tendered.

To Prof. Asa Gray, the veteran Botanist, to whom doubtful points have been submitted, thanks are due.

The zeal and fidelity displayed by Dr. J. T. Rothrock, not only in the field, but in the preparation of his report, and in superintending the collation of other reports, are worthy of all commendation.

The excellent typographical work of the Government Printing Office in the publication of the quarto reports of the Survey is worthy of mention, while the artistic plate illustrations of this volume, furnished by Mr. Julius Bien, of New York City, are creditable alike to his artistic taste and the excellence of his establishment. The plates were drawn by the well-

known botanical artist, Isaac Sprague, of Cambridge, Mass., and Mr. W H. Seaman, of the Agricultural Department.

It is with pleasure that this opportunity is taken of recognizing the industry, perseverance, and skill shown by those whose combined labors have made collections the results from which are embodied in the reports herewith submitted.

Very respectfully, yours,

GEO. M WHEELER,
Lieutenant of Engineers, in Charge.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, United States Army, Washington, D. C.

UNIVERSITY OF PENNSYLVANIA,

Philadelphia, April 1, 1878.

SIR: I have the honor to transmit herewith my final report upon the botanical collections made by the parties under your charge.

In doing so, it is but fair to state how little of whatever merit the report may have is due to myself, and how much to those who have assisted in collecting the material, and to those who subsequently aided in naming and describing it.

Dr. George Engelmann, of Saint Louis, has furnished reports upon the numerous orders and genera that he is our acknowledged authority upon, and these alone form no inconsiderable part of the whole.

Professor Gray, of Cambridge, has throughout kindly settled all doubtful points of nomenclature referred to him. Without his advice and assistance, it would have been impossible for me to have completed the work.

The same may be said of the services of Mr. Sereno Watson. He has also furnished the list and descriptions of the Leguminosæ.

Prof. Thomas C. Porter, of Easton, has worked up the Scrophulariaceæ, Polemoniaceæ, Labiatæ, Borraginaceæ, and Polygonaceæ, orders which together comprise a large part of the descriptive text.

Mr. M. S. Bebb, of Fountaindale, Ill., has written the account of the Willows, which are confessedly among the most difficult of all American genera.

Dr. George Vasey, Botanist to the Department of Agriculture at Washington, D. C., has made a careful report on the Grasses collected by the Expedition; and Mr. William Boott, of Boston, Mass., contributes the paper on Carex.

Prof. D. C. Eaton, of Yale College, has written a most valuable report on the Ferns. This paper differs from the others inasmuch as it is a complete monograph of all the known Ferns of North America south of the 40th parallel and west of the 105th meridian, whether collected by your Expedition or not. It must remain for years the standard authority on the Ferns of that wide area.

Mr. Thomas P. James, a well-known authority on the American Mosses, has kindly prepared the account of these plants; and Prof. Edward Tuckerman, of Amherst College, equally well known in his own special branch, names the Lichens.

The remainder of the text I am responsible for, and though I can hardly hope it will equal the portions contributed by the gentlemen above named, I trust it may be of some value. I have freely quoted from other authors, and have endeavored to give due credit to the sources whence any information has been derived. I have cited the Genera Plantarum by Bentham and Hooker as the authority for the generic descriptions given throughout the Report in the form of footnotes. Though I have in the main simply translated their descriptions, I have occasionally made some changes to suit the particular species I was concerned with. My reason for adhering so closely to these authors as I did was, that the descriptions might be full enough to include other species found in the same region.

It is a great regret to me that the material collected by Dr. W. J. Hoffman, formerly of your Survey, has not been directly available. I have hence been obliged to omit mention of him as the collector of many interesting species from Arizona and Nevada. I take, however, this means of recognizing the value of his work. I have elsewhere alluded to his report on the "Distribution of Vegetation in Portions of Arizona and Nevada," published in the American Naturalist for June, 1877.

Almost the entire botanical collection of 1873 was made by Mr. John Wolf, and it was among the largest and finest ever obtained by a Government expedition.

I was materially assisted, in 1874, by Messrs. Henshaw and Rutter in the work of collecting, and in 1875, by Dr. H. C. Yarrow and Messrs. Henshaw and Shoemaker.

Dr. Loew, throughout his entire connection with the Expedition, has each year contributed largely to the botanical collection. I am also greatly in debt to him for much of the material embodied in Chapters I, II, and III of the text.

I have avoided any change, as far as I could, in the manuscript of the gentlemen associated with me in preparing this report, thinking that a mere uniform mode of expression was of less importance than that each author should state his facts in his own way, and thus avoid the introduction of any errors of my own.

The preliminary portions, *i. e.*, Chapters I, II, and III, I have purposely made popular and avoided all possible technicalities, for obvious reasons. These same parts have also been made much shorter than was originally intended, because the remainder of the volume so much exceeded the limit at first assigned; and, further, because much of the material found its way into Chapter IV.

The plates drawn by Messrs. Sprague and Seaman, and engraved by Julius Bien, need no comment from me. The name of each artist is connected with his work.

There remains now but the pleasant duty of adverting to the generous aid always rendered by you, and by the gentlemen associated with you, both in field and herbarium work, and also by the officers of the various posts I have from time to time visited in performance of my field duties. Without the encouragement received from you and from them, no labor of mine could have collected the material for this report.

Very respectfully,

J. T. ROTHROCK.

First Lieut. GEO. M. WHEELER,

Corps of Engineers, U. S. Army, in Charge.

NOTE, *December* 31, 1878.—Since the manuscript for this Report was completed, the first volume of the Flora of California, by Messrs. Brewer and Watson, has been published; and we have reason to hope for the speedy appearance of the second. This, of course, reduces my labor, so far as the collection of 1875 is concerned, to merely enumerating the plants and adding a few fieldnotes. Anything more would have been not only

unnecessary, but presumptuous, in view of the long labor they and Professor Gray had bestowed upon the task.

During the same interval, American botanists have received from the pen of Professor Gray the first part of vol. 2, Synoptical Flora of North America. It is not possible to overestimate the importance of this to the science of our country. His work, when finished, must be forever the great landmark in American Botany.

Of hardly less importance, or labor, is Mr. Watson's Bibliographical Index to North American Botany, of which Part First, extending through the Polypetalæ, has been published during the year. The thorough manner in which it has treated, and will continue to treat, the synonymy of the subject, renders any extended citations out of place here. It is hoped that the most important changes in nomenclature indicated in these works will be found observed in this Report.

Mr. H. W. Henshaw has aided at the Washington office in his careful attention while this Report was passing through the several stages of proof.

J. T. R.

ADDENDA.

Page 118, under *Ribes Wolfii*, Rothr., add: "This species is still regarded by Mr. Watson as *R. sanguineum*, var. *variegatum*."

Page 272, under *Dasylirion crumpens*, it may be added that recent information from Mr. Watson leads to the belief that this plant will have to be otherwise disposed of under *Beaucarnea* or *Nolina*.

In the Appendix, pages 375 and 376, the following orders were misplaced in printing, i. e., SAURUREÆ, which should have followed EUPHORBIACEÆ; and LILIACEÆ, which should have followed ORCHIDEÆ, as in the sequence of orders observed by the English editor of Le Maout and Decaisne's System.

ERRATA.

Page 8, eleventh line from bottom, for "*serpyllifolia*" read "*chrysantha*", Gray.

Page 9, fourth line from bottom, for "*Abies Douglasii*, Lindl.", read "*Pseudotsuga Douglasii*, Carriere".

Page 24, sixth line from top, omit the words "various species of *Dasylirium*".

Page 183, eighteenth line from top, for "*Campanula Langsdorffiana*, Fisch.", read "*Campanula Scheuchzeri*, Vill."; also, for "*Scheuzeri*", in last footnote, read "*Scheuchzeri*", and omit "var. *heterodoxa*, Gray".

Page 272, eighth line from top, for "*Dasylirium*" read "*Dasylirion*".

Pages 249, 375, and 382, for "*Anemopsis*" read "*Anemiopsis*", see also footnote on p. 49.

Wherever "Fl. Cal." occurs, read "Bot. Calif."

Plate XVII, for "*Hedeoma hyssopicolia*" read "*Hedeoma hyssopifolia*".

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

CHAPTER I.

NOTES

ON

COLORADO.

BY

J. T. ROTHROCK,

SURGEON AND BOTANIST TO THE EXPEDITIONS OF 1873, 1874. AND 1875.

CHAPTER I.

COLORADO DISTRICT.*

FLORA OF THE OPEN GROUND.

The most obvious division of the botanical regions traversed during the season of 1873 would be into the *open grounds*, including under this head the plains from Denver to the foothills, the flat portion of South Park, the immediate valley of the Arkansas, and San Luis Valley proper. There would then remain the mountain region, including here the entire flora from the lower limit of timber to the highest mountain tops.

There is at first sight a wonderful sameness about the flora of the plains, which has not escaped the notice of casual observers. The hoary, dry, stunted plants, with the great preponderance of yellow and red flowers, when compared with the more living aspect of the mountain flora, actually compels a contrast in the mind.

To what is this difference due? Meteorological statistics from Colorado are as yet meagre in the extreme. Up to 1872 from only three points did we have observations for a period of over one year. Such at least is the showing of Mr. Schott's "Tables and Results of the Precipitation in Rain and Snow in the United States", and neither of these points was fairly within the grasp of the mountains, so that any comparison must be somewhat lame. If, however, we sum up and average the fall of rain and snow at Forts Garland, Massachusetts, and Lyon, it appears that the mean amount is 12.09 inches. This, however, can only be taken as an approximate estimate for the more open country just east of the main divide, being probably greater than the fall farther east, and certainly less than that west.

* I have taken this chapter on the Colorado District from my Preliminary Report, published in 1874.

Compare this with 39.87 inches, which is the mean precipitation for a series of years in West Virginia. This State is selected because it has some points of similarity to Central Colorado, and because its precipitation is far from excessive. The difference is so great as to suggest that this is an essential feature in the difference of the floras in Colorado, where we probably have a difference as great between the meteorological conditions of its plains and its mountains, as between West Virginia and Colorado.

Another meteorological element will probably be sufficient to explain the problem in part. Where we have so small a mean precipitation, it is safe to infer that the atmosphere comparatively seldom reaches the point of saturation; *i. e.*, that there is less than the ordinary amount of aqueous vapor in it. Then it follows that however much of the sun's heat be absorbed by the soil during the day, it will be most freely radiated back into space at night. I cannot better illustrate the full import of this fact than by a quotation at second hand from Tyndall: 'Aqueous vapor is a blanket more necessary to the vegetable life of England than clothing is to man. Remove for a single summer night the aqueous vapor from the air which overspreads this country, and every plant capable of being destroyed by a freezing temperature would perish. The warmth of our fields and gardens would pour itself unrequited into space, and the sun would rise upon an island held fast in the iron grip of frost.'

These, then, being the climatic conditions, somewhat, of the plains during the growing period of the year, it does not seem strange that the *ensemble* of the flora should be as peculiar. The diurnal range of temperature during the summer months is at times immense. In South Park, I have seen the temperature as high as 90° Fahr. at 2 p. m., and on rising the next morning found a film of ice coating the little accumulations of water around camp. Our *familiar forms* of plant-life would almost all be destroyed under such an alternation of heat and frost for year after year. The plants, then, that we do find surviving are, as a rule, more dwarfed, more villous, and with denser tissues than those of more genial regions. Nature would appear to have especially guarded them against excessive evaporation of their fluids on the one hand and freezing on the other, and meeting both contingencies by a small supply of water in their tissues, retaining that

which they possess under the double guard of villosity and contraction. I am aware that Mr. Watson, in his most valuable report on the Botany of the Fortieth Parallel, is prepared to admit a large evaporation from the more succulent portions of the plant.

The monotonous character of the flora of the drier regions does, in some measure, disappear, when, on examination of these plants, so uniform in general appearance, we find a large number of genera and species differing from one another by the small amounts *compatible with their surroundings*. This (the surroundings) in part accounts for the predominance of some orders and often of genera. We find a somewhat similar condition of things in the centre of greatest development of the *Proteacea* in Australia, or of the *Pelargoniums* in South Africa.

Comparatively few of our Eastern plants are found in these open grounds, and where one does occur it is apt to be a cosmopolitan weed, whose pliant constitution adapts it to any condition of life, as well as to the hostility of man. *Polygonum aviculare* and *Chenopodium hybridum* are examples. Among the exceptions to this statement is *Ranunculus Cymbalaria;* but its natural habitat on the Western open lands is, by choice, alkaline soils, where, for a portion of the year at least, it can obtain moisture, just as with us it frequents salt-marshes and the sea-shore.

Among the mountains, on the contrary, we find a larger number of familiar plants. Indeed, the list is so large that it would be a real labor to begin the enumeration. Those plants embraced under the common name of weeds are from necessity found usually on the roadsides and about habitations, just where they can be transported by human agency, and find, among other essentials, water. It is wonderful with what rapidity they have occupied the ground in many places.

FLORA OF THE MOUNTAINS.

Leaving the level ground, we at once come fairly within the range of the timber In South Park, this is not far from 10,000 feet altitude: tongue-like projections of trees do extend lower down; but I refer to the main body of the forests.

At Twin Lakes, the timber begins at about 9,500 feet. In the San Luis

Valley, it is much lower, about 7,500 feet above the sea. Here, however, the lowland coniferous growth is made up entirely of *Pinus edulis*, Engelm, and *Juniperus Virginiana.*

It seems that where the hills begin fairly, they have been seized at once by some tree. Cottonwood trees appear both on the plains and mountains, where the supply of water is constant or nearly so. The Conifers above named are constantly found associated on the foothills at least as far north as Cañon City. They do not fairly enter South Park. The line along the Valley of the Arkansas is sharply drawn. The ridge dividing it from Trout Creek is covered on its western slope by these trees, while to the east of it they hardly appear.

From some facts observed I am led to think that at no distant past the growth of *Coniferæ* extended much lower into the Park than it now does. I have seen the decaying remains almost down to the Platte. The knots, which, as is well known, last a long time, were found scattered here and there frequently in the lower portions of the open ground. An occasional isolated clump of these trees still survives, far removed from their associates on the mountain-sides; and at times one may observe that the prolongations of pine-woods, which extend out into the Park, become less and less dense, until finally only a single tree remains at intervals, these disappearing, and then only the half decayed remains reach farther out toward the valley. In one place it was observed that the tops of these dead trees all pointed to the east. This suggested the idea that the destruction may have been due to one of the fierce west winds which, during the fall months, are so prevalent in South Park. Once destroyed, other vegetation might readily crowd the young trees out. A notable example of this was seen in one portion of the foothills, where a whole forest of *Pinus edulis* lay prostrate, with not a single young tree coming on. As bearing upon this question of recession of the *Coniferæ* toward higher ground, I may also remark that where these tongues of timber run down toward the centre of the Park, the oldest trees are *Coniferæ* and the younger growth is of cottonwood. This is especially marked at the lowest limit of the trees. Perhaps mere "rotation of crop" may serve to explain the change, *though I doubt it.*

The timber belt ends at about the greatest centre of development of

the nutritious bunch-grasses, though these do extend in magnificent growth up into the open valleys and among the less dense timber to an altitude of nearly 11,000 feet.

From South Park to the New Mexican line we regularly found abundance of this forage on the eastern slope of the main chains. In the beautiful valley of the Conejos River, after striking the timbered region, we found luxuriant bunch-grass covering the ground as thickly as it could stand. In November it was still green about the roots, and was eagerly eaten by our starved mules. *Pinus ponderosa* formed open clumps, and under protection of these trees it attained what seemed to be its maximum growth.

From 9,500 to 10,500 feet the principal arboreous growth was made up of *Pinus contorta*, *Pinus ponderosa*, *Abies Menziesii*, and *Abies subalpina*. *Pseudotsuga Douglasii* seemed more at home at a somewhat less elevation. *Pinus ponderosa* was frequently seen to extend in full size almost to the verge of the timber-line, and often to attain its largest growth at an elevation of 11,000 feet.

In this belt (from 9,500 to 10,500 feet), *Berberis Aquifolium* formed a conspicuous feature of the flora, especially in the more open woods. The herbaceous vegetation of the same zone is well represented by *Castilleia pallida*, *Parnassia parviflora*, *Pedicularis Grœnlandica*, *Habenaria dilatata*, *Polygonum Bistorta*, *Trifolium dasyphyllum*, *Senecio triangularis*, *Gentiana detonsa* and *acuta*, with several species of *Pentstemon*.

From 10,500 feet to timber-line (approximate estimate, 11,500 feet), a change more or less marked occurs in the vegetation. This zone embraces within its limits a greater diversity of soil, exposure, and local differences of temperature than the one we have just described. There are open valleys with perfect drainage, and hence dry soil; and others so swampy that it is almost impossible to ride over them; rocky slopes and deeply shaded ravines, which are always damp from the spray of a mountain stream. Hence it is not surprising that a more diversified flora should be found here. *Pinus flexilis*, continuing over from the lower zone, now in this its favorite altitude, becomes the predominant Conifer. It is subject to great changes in its habit, and among these there is none more remarkable than

the greater crowding of its leaves as you reach the still luxuriant though more alpine forms. The herbaceous vegetation is represented by *Primula Parryi*, *Adoxa Moschatellina*, *Trollius laxus*, var. *albiflorus*, *Caltha leptosepala*, and *Trifolium Parryi*; the first four finding in the cold streams and snow-fed bogs most congenial homes.

At timber-line, a most complete change comes over the landscape and with it, over the flora. *Pinus Balfouriana*, after becoming more and more common as we ascended the last thousand feet, has now attained the supreme place in the tree-flora. Except it, all other trees have disappeared under the increasing rigor of the alpine surroundings. It, too, has been dwarfed to the last degree compatible with the dignity of a tree. Where timber-line coincides nearly enough with the summit of the mountain to allow the strong west winds of the region to exert their full force upon the tree, it lies prostrate, with the top always pointing eastward, and having just enough of leaves, often, on its stunted branches to give sign of life. When some high cliff affords a shelter, the tree rises perpendicularly until the top is above the protection afforded, and it is then forced to take the eastward inclination

From timber-line up, the surface may be bare of all vegetation, and simply a mass of rocks (often volcanic), or it may be more or less densely covered with a mixed sward of grass and sedges. Here and there, blooming in profusion, will be found clumps of *Dryas octopetala*, *Trifolium nanum*, *Saxifraga Hirculus* and *flagellaris* and *serpyllifolia*, *Actinella grandiflora*, and *Gentiana Parryi*. The last-named was found in full bloom near the summit of Red Mountain in August. Dwarfed specimens of *Solidago Virga-aurea* and *Salix reticulata* mingle themselves with the grass of the sward, and almost escape detection until looked for closely. Even these disappear as we approach an altitude of 14,000 feet, and there remains then hardly anything except *Claytonia arctica*, which sends its long, thick root deeply down among the rocks after its nourishment.

TIMBER

Pinus contorta, Dougl.—("Twisted-branch Pine;" "Red Pine.")—This tree grows 40 feet high, and has a diameter of about a foot; wood

is coarse-grained. Where nothing better offers, it may be sawed into boards.

Pinus flexilis, James.—("American Cembran Pine.")—Attains in Central Colorado a height of 50 feet in its best situations, with a diameter of a foot and a half. The shape and color of the cones as well as the pliable character and white wood of the young shoots are, as Dr. Parry has already noted, strikingly suggestive of the White Pine of the East. The extremely slow growth of this tree is remarkable. The trunk, as a rule, is quite too full of knots to make good boards, though there is no reason why the less stunted specimens might not be used for coarse, heavy timbers.

Pinus Balfouriana, Murr.—This tree is seldom, if ever, found at an altitude less than 9,000 feet above the sea. It is the last to survive the exposure on the mountain-tops; and finding a pine at timber-line is presumptive evidence that it is this species. It grows sometimes 35 feet high and 18 inches in diameter; has little value as a timber.

Pinus edulis, Engelm.—(Piñon Pine of Southern Colorado.)—The *Pinus edulis* is the one so frequently alluded to by Frémont as the Nut Pine. It furnishes capital fuel, having enough of the terebinthinate in it to make an intensely hot fire. This is the most important use to which the tree is applied. It ranges from the hills near Cañon City south, not going into the mountains west until it has crossed the valley of the Arkansas southward.

Pinus ponderosa, Dougl.—("Yellow Pine" of the West.)—This is the largest and most valuable of the trees in the region surveyed during the season of 1873. It makes the best lumber the country affords, and, besides, is quite abundant, though this fact will probably be the reason why it will be the first to be extirpated before the growing needs of an increasing population. In the valley of the Conejos River, it was found growing 60 to 70 feet high, with a diameter of nearly three feet.

Abies Douglasii, Lindl.—Tree 60 to 90 feet high, though becoming much smaller as it ascends the mountain sides. As a timber it is only middling in quality. It does well for beams, &c. It becomes much larger and more valuable on our northwest coast and has fewer knots than on the

Rocky Mountain ranges It is known according to Mr. Watson, in the Uintah Mountains as "Bear River or Swamp Pine".

Abies Menziesii, Lindl.—This tree attains an average height of from 50 to 60 feet. Timber hard and coarse-grained, but is serviceable for rough work.

Juniperus Virginiana, L.—A much branched, dwarfed tree, found associated with the Piñon Pine. It is of great value as furnishing the most durable fencing-posts. It is probably abundant enough in Southern Colorado to meet the demands for many years.

There are, besides, several species of cottonwood, none of them, however, being of any great value except for shade.

It may be well to remark that, on almost any, if not all of the ranches where irrigation is possible, in a few years the settler may relieve the constant glare of the sun by a fine, thrifty cottonwood grove about his buildings. The experiment has so often succeeded that it is no longer a problem to solve.

AGRICULTURAL RESOURCES.

Taking Denver as a starting-point, it is known that fair crops of wheat, rye, oats, barley, and corn may be raised with a tolerable degree of certainty where irrigation can be resorted to. The same statement is true of the region east of but bordering the foothills, as far south as the survey extended this year (1873); the certainty (other things being equal) increasing toward the south. Grasses and sedges suitable for grazing purposes flourish in greater or less abundance, especially as the foothills are approached and the valleys between them penetrated into.

The drier portions of the country (especially where water is within reach) may be advantageously utilized as sheep-walks. The grass of such regions is nutritious and abundant enough for this purpose. As an illustration I may allude to Huerfano Park, which now affords pasturage to immense droves of sheep. The great objection to allowing them indiscriminate range is, that where they go, the grass is so soiled that horses and cattle refuse to touch it. Hence the bitter antagonism between the two classes of herdsmen. An equitable division of the *public lands* would be to confine the sheep to the region of the shorter grasses, giving cattle and

horses the range of the taller bunch-grass. Of course, when the land was definitely settled, surveyed, and paid for, the proprietor would consult his own individual interest.

Along our route, the possibilities of agriculture died out as we approached Georgetown, though here and there an acre under cultivation showed that the farmer must have received some return for his labor. The valleys still furnished a fair quantity and quality of bunch-grass.

We leave the country between Georgetown and South Park out of the question for agricultural purposes. There were, as usual, some beautiful summer ranges for herds. One especially, along a tributary of the Snake River, was covered with a luxuriant crop of grass. The soil, too, was fertile, and, but for its altitude, would have produced large crops of the ordinary cereals.

South Park, 8,800 feet above tide-water, so far as known does not promise much in the way of grain raising. It has frequent frosts during the summer months, and the temperature at the same time is so low as to almost inevitably destroy all the cereals. On the morning of July 3, 1873, the ground was covered to a depth of two inches with snow as low down as the level of Fair Play. Its utmost will probably be accomplished in the way of agriculture in the production of turnips, cabbages, and possibly potatoes, with other vegetables equally hardy. It will, however, be an important grazing ground. Large herds of cattle now roam at large over it. In 1872 and in 1873, the experiment was tried of wintering the stock in the Park. It is asserted that it was successful, and that the herds kept there were in better condition in spring than those that had been driven for the winter to the valley of the Arkansas.

The bunch-grasses in the smaller parks toward the mountains are of wonderful luxuriance, and will furnish abundant food for many thousand head of cattle. Sheep do well on the more level portions of the Park, among the shorter grasses.

The valley of the Upper Arkansas, as we first saw it, twelve miles above Twin Lakes, certainly looked like anything but a land of promise. Along its central axis, the soil appeared absolutely unproductive, and seemed fit to raise nothing but "prickly pears and sage-brush". Yet we have

abundant evidence that, if the climate were not too rigorous, under irrigation this same soil would raise fair crops. The smaller valleys leading down from the mountains on either side and intersecting the main valley at right angles all produced abundance of bunch-grass, though not so luxuriantly as South Park. In crossing into this valley from South Park, we had made a descent of some 400 feet, and found as a rule a climate proportionately more genial. At Twin Lakes, potatoes grew large enough to be eaten before the early frosts destroyed the tops. It is not improbable that some of the hardier grains might be raised at this point. By September, the yellow leaves on the cottonwood-trees along the mountain slopes indicated plainly enough that we had reached the limit of the "growing-season" there.

Reports reached us of fertile valleys with abundant pasturage west of Twin Lakes.

The first fairly good farm we saw after leaving Denver was that of Mr. Lenhardi, on the Arkansas, twelve miles below Granite, August 27. We found that Mr. Lenhardi had just finished his harvest. He had a good crop of oats, barley, and potatoes. He admitted, however, that his success was earned by continuous irrigation through several months. Below him were several other ranches equally good. So narrow was the belt of fertile land that the ranches were often over a mile long, and hence, to include the legal one hundred and sixty acres, could not have been wide at any point.

Following down this valley, we saw the first flouring mill at Chalk Creek. It was probably the best indication that we were not far from the northern limit of successful cultivation of the ordinary cereals.

Leaving the Arkansas Valley at McPherson's ranch, we crossed the Saguache Mountains via the Puncho Pass, which is reported as 8,600 feet high. It is probably somewhat over this estimate, though still far below timber-line. South of us lay San Luis Valley, concerning the agricultural value of which there are so many contradictory reports. Settlers in the valley are loud in its praise; others are, as a rule, loudest in their disparagement of it. It may be premised that snow seldom falls to any depth, or lies long on the ground. These conflicting reports probably find their solution in the fact that the most important roads over which by far the largest share

of the travel passes were located in the most barren portions of the valley; hence those simply passing through it receive a most unfavorable impression as to its resources.

To make this statement more clear, we will make the following divisions of the valley:

First, that portion bordering the water-courses, where the soil is confessedly fertile and irrigation is possible. The land lying along the banks of the Saguache is the best illustration of this. The soil is the product (on the surface) of the immense crops of rank sedges and grasses that have for centuries grown, died, and decayed there. To say that it is as fertile as land can be, is not in the least overstating the truth. "Breaking it up" is simply preparing a vast compost pile for "seeding".

The following facts were obtained from Mr. Frank Brown, one of the most reliable men in the valley: Oats per acre produce 40 to 50 bushels, weighing 40 pounds per bushel; barley per acre produces 50 bushels, weighing 55 pounds per bushel; "bald barley" per acre produces 50 bushels, weighing 75 pounds per bushel; wheat per acre produces 30 bushels, weighing 65 to 68 pounds per bushel; potatoes per acre produce 300 bushels, of course an unusual yield; turnips, onions, beets, radishes, and cabbages yield well and grow to an immense size. I can personally vouch for the truthfulness of most of these facts. (I find, on looking over a letter received from Mr. L. A. Phillips, of the "Colorado Farmer", that the estimate of the crops for Colorado is, on the average, per acre, wheat, 28 bushels; oats, 40 bushels; potatoes, 150 bushels; corn, 25 bushels; and barley, 35 bushels. This estimate is by no means a fair showing for the corn of certain portions of the Territory. Fall grains have not yet been extensively enough tried to test the relative merits of fall and spring crops.)

Along the Carnero, Lagarita, and Rio Grande, the soil is not so productive of large crops as the Saguache region; but, to offset this, it is found that the crops are perhaps less likely to be injured by early frosts, and a larger variety of productions may be depended upon. In fact, all our ordinary garden vegetables grow on the banks of these streams.

Despite all that has been said of the general innutritious qualities of

sedges as a forage, the stock in the San Luis Valley thrives the year around on them. There, over thousands of acres, these plants grow more than four feet high.

Irrigation is possible anywhere in this first division, and water (slightly brackish) is usually obtained by digging a few feet.

The second division is made up of the higher ground, beyond reach of irrigation. The soil and its productions undergo a complete change. Grama,* chico, and greasewood are here the prevailing growth. The soil is unpromising in appearance, yet would, if irrigation were possible, produce fair crops. It will not be likely to be brought under the domain of agriculture for many years. Most propitious seasons are, in the absence of water, absolutely required for this kind of soil. It is, however, the legitimate sheep-walk of the valley.

The third division are the sand-wastes, where there is no water and almost no vegetation. Even the chico and sage-brush are barely able to live there. I know of no use to which it can be put. There are some sheep occasionally found on it, but they derive most of their subsistence from the adjacent *vega*, or lowland.

It is known, also, that in the smaller valleys between spurs of the mountains, bunch-grass is found in considerable quantity. The piñon-groves furnish shelter and a certain amount of grama during the winter for the herds that frequent them.

From Loma, south, wheat has long been a regular crop. Corn, too, produces small ears with certainty at Conejos. It is not unlikely that they could be increased in size by the introduction and thorough acclimation of better seed.

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* The term *Grama*, now applied to the various species of *Bouteloua* in our Southwest, evidently comes from Spain. It is there applied to what we know here as *Bermuda*, or *Scutch-Grass* (*Cynodon Dactylon*, Pers.), introduced among us from Southern Europe, and also found now widely distributed over the warmer parts of the globe. *Gramma* is incorrect, and *grass, as a suffix, is superfluous.* The use of the name was evidently suggested here by the one-sided arrangement of the spikelets,—so like that in *Cynodon Dactylon.*

CHAPTER II.

NOTES

ON

NEW MEXICO.

BY

J. T. ROTHROCK,

SURGEON AND BOTANIST TO THE EXPEDITIONS OF 1873, 1874, AND 1875.

CHAPTER II.

NEW MEXICO AND ARIZONA DISTRICT.

This district may be fairly considered as starting on the latitude of Fort Garland, a little north of the southern line of Colorado, and extending thence west to Loma,* on the headwaters of the Rio Grande. True, a marked change in the flora appears about the headwaters of the Arkansas and runs east out into the western edge of the Great Plains at Pueblo, whence it shades off gradually more markedly into the flora of the warmer and more arid regions as we go toward the south. North of this the Piñon Pine seldom appears in Colorado; and about Pueblo not less than ten species of *Cactaceæ* appear somewhat suddenly in the flora.

Taking, however, the southern portion of the San Luis Valley, as I have done, from Fort Garland to Loma would appear to be a more strictly natural division, because south of it the change is marked in the flora, and is further confirmed by a corresponding change into larger areas of almost desert land, and by a decided decrease in the relative quantity of humidity in the atmosphere, with a resulting smaller number of springs and running streams. Still, along the mountains, or on isolated mountain peaks, even almost so far south as the Mexican boundary, we find enough of characteristic Northern plants to suggest the inquiry as to whether the influences of the Glacial Period may have extended so far south, and driven these plants before it, as it did those of Labrador to the latitude of New Jersey and Pennsylvania on the Eastern coast. For example, we find among the mountains of Southern Arizona, *Habenaria leucostachys*, *Habenaria dilatata*, *Goodyera Menziesii*, *Spiranthes Romanzoffiana*, and *Corallorhiza Macræi?*. All of these

* I assign Loma as the western limit only because it was the western limit of my exploration.

are strikingly suggestive of a more northern birthplace. Besides this, there are *Veratrum album*, *Zygadenus glaucus* and *Z. elegans*, and *Picea Engelmanni*, which tend further to raise the same point of inquiry. The presence along the southern border of Arizona of that somewhat rare and localized fern, *Ophioglossum vulgatum*, in our present state of knowledge, can only remind us that there are still some points concerning the geographical distribution of plants that are unsettled; the most probable conclusion, however, being that (if we banish separate centres of creation for the same species) it has at one time extended over almost our entire North American area. Its present situation in Arizona (on a low hot plain) divorces it from any necessary association with glacial agencies.

From Southern Colorado to the Zuñi Mountains in New Mexico, we may in the main make the journey, and avoid any considerable mountain-range. North, the "Spanish Mountains" of the older maps will be to the east; and further south, to the west, the various spurs will culminate in the Valles Mountains and the Nacimiento Range, whose highest peaks seldom, if ever, reach an elevation greater than 12,000 feet, while most of them are much lower. Along the valley of the Rio Grande, the general altitude ranges from about 7,700 feet to 5,026 feet at Albuquerque. This valley, whilst much cut up by transverse cañons and smaller streams, is in the main an area of aridity. Along the streams, the ever-present cottonwood will appear; the sandy or gravelly wastes be covered with the various Artemisias, Nyctaginaceous and Chenopodiaceous plants; and the mesas (or high tablelands) intervening between the streams will be covered with a sparse growth of bunch-grass and grama. Representatives of the *Cactaceæ* will be found constantly.

Santa Fé, just south of the mountains of the same name, is situated at an altitude of 7,047 feet. The plain around is, except where watered by the small stream from the mountain behind, barren in the extreme; not, however, because the soil lacks the elements of fertility, for this it does not, but because it needs an abundant supply of water.

So long ago as 1846, Mr. Fendler made large collections at this place, and as the results are so well known it is hardly requisite to do more than allude to the general outlines of the flora. The mountain-slopes back of

the town of Santa Fé are covered with *Abies concolor*, *Pinus ponderosa*, and *Pinus flexilis*. Their summits, however, not reaching above timber-line, are destitute of the peculiarly alpine flora so characteristic of the Colorado mountain-tops. Back of Santa Fé, the low hills also are abundantly covered with the Piñon Pine and dwarf *Juniperus Virginiana*. The extremes of heat and cold within a period of twenty-four hours, though still plainly marked here, are not so decided as on the great American plains further north, and this would appear to have something to do with the *Cactaceæ*, *Chenopodiaceæ*, and *Nyctaginaceæ* taking the place of the more hairy *Astragali* we find there (to the north).

From Santa Fé we moved toward the Rio Grande, which we struck at the Indian town of San Felipe. The intervening country was of the semi-desert character, and furnished a scanty picking for the small bands of cattle that roamed over it.

The valley of the Rio Grande, however dreary its appearance, gave evidence of an abounding fertility where irrigation is possible; I might almost have said an *inexhaustible fertility*, for at some of the Indian farms we could see where year after year they had raised fair crops without either rotation in crop or any attempt at restoration to the soil of the elements of fertility they were so constantly removing. The combination of lime, sand, and marl from the eroded country above and back probably gave the explanation of continued success under such soil-impoverishing farming. This belt, however, was at best a narrow one, for the immediate hills were as usual covered with a growth of sage-brush and *Atriplex*. It was interesting to note here, as elsewhere, the protective influence of vegetation on the face of the country. Facing the mouths of the ravines, which ran toward the river, were here and there elevated spots, whilst all around evident traces of recent washes in the soil were apparent. The elevations owed their existence to the growth of *Atriplex* and *Artemisia*, the roots of which entangled, or rather retained the sandy soil about them. I have had frequent occasion to note the same thing, especially in California. The common *Ailanthus glandulosus*, which has become so much of an "eye-sore" on our Eastern coast, might almost certainly be introduced into that region as a protection along the irrigating channels and elsewhere, where some such

restraining force was required. It is known to be especially adapted to this end, as is shown by actual trial on a large scale in an area further north, but almost as dry. From Albuquerque across to Fort Wingate, which is about one hundred miles and north of west, the face of the country hardly improves. It is in the main a poorly watered, poorly timbered region, with an altitude ranging between 5,100 feet and 7,000 feet. Here and there a good spring occurs, or an occasional small stream puts in a hesitating appearance—to rise to the surface, or sink below it, no one can tell how often, before it strikes a larger main channel Until we reach McArthy's ranch, west of Cuero, agriculture is out of the question. Small bands of sheep may, and do find a living in the country adjacent the springs and water-courses. From McArthy's ranch on to Wingate, the country slowly improves, and in many places along the road, ground under cultivation testified to the capacity of the soil for production of the cereals. The water is more or less alkaline, and some of the strongest springs are notably so. In many of the spots (where in certain seasons the ground is wet and then dries up), we found the usual saline efflorescences covering the surface. Such places always had a more or less dense covering of the so-called salt-grass of the West (*Brizopyrum spicatum*). This was eaten by the burros, but neither horses nor mules could be induced to touch it, except in instances of absolute want, and then it appeared to be not only innutritious, but after a time absolutely hurtful.

The western slope of the Valley of the Rio Grande from the northern end of the Black Mesa leads upward into an elevated region, the lower portions of which are cut up into tableland, *i. e.* mesas, separated by almost impassable cañons. Over these mesas, grass in moderate quantity is found. Gaining elevation, however, as one goes west, the surface of the country changes; at 7,000 feet, it becomes mountainous. The timbered ridges have well watered and grassy valleys between them. This continues southward as far as Nacimiento. Here a change comes over the landscape, and thence south to San Mateo we have to all intents and purposes a desert country. At San Mateo, this more western strip joins on to the somewhat improved belt of country I have described as commencing at McArthy's ranch, and the two proceed southward, gradually improving, until at about 7,000

feet we meet the heavily timbered ridges of the Zuñi Mountain Plateau. Here the flora presents a marked change, *Pinus ponderosa*, *Pseudotsuga Douglasii*, and *Abies concolor*, with here and there a straggling Oak-tree, make up the tree flora of the higher parts, whilst at lower levels the Piñon Pine and the Western form of our Eastern Juniper appears. Damp ravines, swamps, and running brooks give chance for the growth of grasses, *Junci*, and *Carices*. Beautiful Pentstemons confer an unusual charm to the scenery, all the greater because of the desert country we have passed through to reach this range.

The main trend of this chain is from the present Fort Wingate toward the southeast to a point to the west of and some thirty miles from Limita on the Rio Grande at Ojo de la Rosa, where the outlying spurs join with those of the Sierra del Datil coming in from the southwest. The triangle of land thus enclosed is dry, but not always level. Mountain-chains of short length run here and there; water is only moderately plenty, and the timberless character of even the more elevated parts is in strong contrast with the description given by Lieut. C. C. Morrison of the Zuñi Mountains: "Following the axial line was a wide valley running nearly the entire length of the range, abounding in the most beautiful glades with bunch-grass 18 inches high, standing as thick as it could grow, here and there rooted out in the damper places by red and white clover. The Zuñi Mountains are a low range, reaching in no place much over 9,000 feet." From these mountains south we again enter a region more or less desert in its character, the only timber being the Piñon Pine and *Juniperus*. Here and there water may be found as at Zuñi and Deer Spring and Cave Spring. In the damper areas, luxuriant growths of sedges and the common *Mimulus luteus* showed what the capacity of the soil was. In this area, an occasional basin may be found in which corn, etc, can be raised without irrigation. Such a one was observed just south of Zuñi. The probable explanation is that a sub-soil of clay retains the moisture which is drained in from the higher grounds around, and the dry, sandy soil allows the seed to be planted a foot deep to meet the ascending moisture without being rotted in its somewhat prolonged struggle upward into sunlight. Sometimes for miles, as in a valley south of Deer Spring, the soil is actually a

black bed of vegetable mould, on which a heavy sward is found. This probably would indicate, as the appearance of the surrounding country tends to confirm, that water may be had here at no great depth. Indeed, it appeared as though part of the season this especial area might be rather swampy.

From Zuñi south, the country may be regarded as sloping toward the Colorado Chiquito, and fairly merits the designation of "a dry rolling country". Thence south it again ascends to the White Mountains of Arizona, a densely timbered range, culminating in Mount Ord, 10,266 feet high, and Mount Thomas, 11,496 feet high. The road to Camp Apache crosses it at an elevation of about 7,400 feet; Willow Spring, somewhat lower, gives an altitude of 7,195 feet. Here the scene was one of transcendent floral wealth. The ordinary coniferous growth, to which we have already alluded, mixed in about equal proportions with *Quercus undulata*. The Conifers towered up sometimes more than a hundred feet, but the Oaks were seldom over 25 feet high, but branched out vigorously. The declivities of this range are deeply cut by cañons extending out from the centre like so many radii of a great circle. The soil is largely made up from disintegration of volcanic rocks. The herbaceous vegetation was luxuriant beyond anything elsewhere seen in Arizona, and here only was the striking *Sisyrinchium Arizonicum* found. *Frasera speciosa*, *Onosmodium Thurberi*, and acres of *Aquilegia chrysantha*, luxuriated on the hill-sides; whilst in the cold spring-water *Claytonia Chamissonis*, *Ranunculus hydrocharoides*, and *Habenaria leucostachys* were growing abundantly.

Though in Arizona, these mountains are deeply covered with snow each winter, so much so as to practically serve as barriers, the dense growth of timber seen on them is simply a portion (possibly the best portion) of a belt extending from old Camp Tulerosa westward to Camp Verde, a distance of about three hundred miles. It is known under the general designation of the Black Mesa, or the Mogollon Mesa. It is really an island of verdure raised up out of the more desert areas north and south of it. Its average width is not great. "The Carboniferous strata predominate, but the southern extension is covered by basaltic eruptions."*

* Loew, vol. iii, Wheeler's Report, p. 587.

The following analysis of the soil is given by Dr. Oscar Loew, chemist and mineralogist of the Survey, vol. iii, p. 587:

Physical condition: color, dark; consistency, loose.

	Per cent.
Sand	42.20
Silt and clay	37.98
Hygroscopic moisture	10.97
Humus and chemically bound water	8.84

Chemical constituents:

	Per cent.
Potassa	0.015
Soda, Lithia	traces
Magnesia	0.029
Lime	0.153
Phosphoric acid	0.058
Oxide of iron, Alumina, Sulphuric acid, by diff.	2.013
Total soluble in hydrochloric acid, water included	22.188
Insoluble quartz and clay	77.812

The rock from which the above soil was derived is a red sandstone.

The San Francisco Mountains may be regarded as a northward extension of Mogollon Mesa, having the same average altitude (7,000 feet) and the same dense timber-growth, with here and there fertile valleys and open glades.

South of the Mogollon Mesa, the altitude of the country decreases until at Camp Apache we are but 5,000 feet above tide-water, and in Tonto Basin to the west of Camp Apache lower still, probably between 3,500 and 4,500 feet. The word basin correctly represents this cañon cut and crossed depression, of which we have yet so much to learn.

Crossing a series of mesa lands at an elevation of 6,000 to 7,000 feet, we begin the descent to the parched, superheated valley of the Gila River. A complete change comes over the flora. If verdure and superabundant vitality were the expression of plant life on the timber clad Mogollon Mesa, in the valley of the Gila, hardness of texture and contraction of form would be characteristic of the flora. The attempt to make an analysis of one's

feelings on being somewhat unexpectedly brought face to face with this peculiar vegetation would be futile, as no point of comparison appears to offer. The giant *Cereus* occupies the hill-sides which have a southern and southeastern exposure, towering up to a height of from 30 to 50 feet. *Fouquieria*, with its leafless, wandlike trunk, and its tip of scarlet flowers, *Agave Palmeri* and *Parryi*, and various species of *Dasylirium*, dry, rigid skeletons of plants without the living green; *Canotia*, a tree 20 feet high, a foot in diameter, with green branches provided with stomata, but no leaves, all go to complete this desolate floral landscape While the *Mimosæ*, *Acaciæ*, and *Caliandræ*, rising to the dignity of trees or dwarfed to mere underbrush, inhabit the less dry hillsides and ravines, but still by their small leaves and hardened tissues show that they too have the impress of the dry, hot air about them. What the vegetation and climate of this valley may once have been we have now no means of certainly knowing. It is, however, in the highest degree probable that the process of desiccation, which has long been taking place in portions of New Mexico, is going on here. Along the higher bluffs back from the river, and far away from any chance of irrigation, one still sees the ruins of ancient pueblos, and in places traces of agricultural operations.

Barren as the soil appears in its present dried condition, it has the capacity for production of luxuriant crops of corn, barley, cabbage, onions, potatoes, and watermelons where water can be furnished, as the garden at old Fort Goodwin proves, and as the Mexican Pueblo Viejo, some twenty miles further up the river, amply confirms.

Leaving here an altitude of less than 3,000 feet, we again begin the ascent over a rolling country, and reach some twenty miles to the south an altitude of 4,833 feet at New Camp Grant. North of this, Mount Graham rises out of the plain, and attains an altitude of 10,357 feet. It is stated by Mr. Gilbert* to be made up on its northeastern face of gneissic rocks and a syenite, the great mass being probably metamorphic. As a single isolated centre, it presented more novelties than any other spot visited by us. *Picea Engelmanni* was found even so far south. I have elsewhere called attention to the number of more northern forms that we obtained from near its summit.

* Vol. iii, 509, Wheeler's Report.

As might be expected, *Pinus ponderosa* was the prevailing tree, and attained magnificent proportions. Skirting the flanks lower down, we found growing abundantly the *Madroño* (*Arbutus Menziesii*, Pursh) and *Manzanita* (*Arctostaphylos tomentosa*), but not here attaining a height greater than 10 or 12 feet. The Oaks do not range higher than 6,500 feet on the slope of this mountain. The northern slope of Mount Graham has a barren aspect, the timber apparently not reaching so low a level as on the southern side. This may be due to the steeper declivities, as well as to the greater heat radiated from the Gila Valley. In the more open woods, from 7,000 to 9,000 feet, bunch-grass grew most luxuriantly; and in the moister ravines leading from the mountain down to the plain, sedges grew in dense masses, and furnished (current teaching to the contrary notwithstanding) a much-prized food for the stock ranging on the mountain. Whilst at Willow Spring we found the *Aquilegia chrysantha* growing abundantly in the open and on somewhat dry ground, on Mount Graham it was hardly ever seen away from the spray of a shaded mountain stream.

The Pinaleño Range, of which Mount Graham may be regarded as the culmination, trends off toward the southeast, becoming reduced more and more as it nears Railroad Pass, a distance of about twenty miles from Camp Grant. This pass serves to connect the Arivaypa Valley on the west with the plains of San Simeon on the east. This flat, dry region has a varying altitude of from 4,239 feet at Eureka Springs to 4,833 feet at Camp Grant, and thence descending to 3,485 feet at Whitlock's Cienega.

Camp Bowie, situated in Apache Pass in the Chiricahua Range, which may be regarded as on the southern border of the San Simeon Plains, has an altitude of 4,872 feet.

From Camp Grant to Camp Bowie, the route is over an exceedingly dry region, the distance being about fifty miles, and water is to be found at one point only, and here not with certainty. In the sandy arroyos were found growing *Baccharis sergilloides* and *B. cærulescens.* The local opinion is that these plants will not grow where their roots cannot reach water. There is no doubt that in many places where it grows, water may be had on digging to a little depth. *Tessaria borealis* was also a common plant of the region.

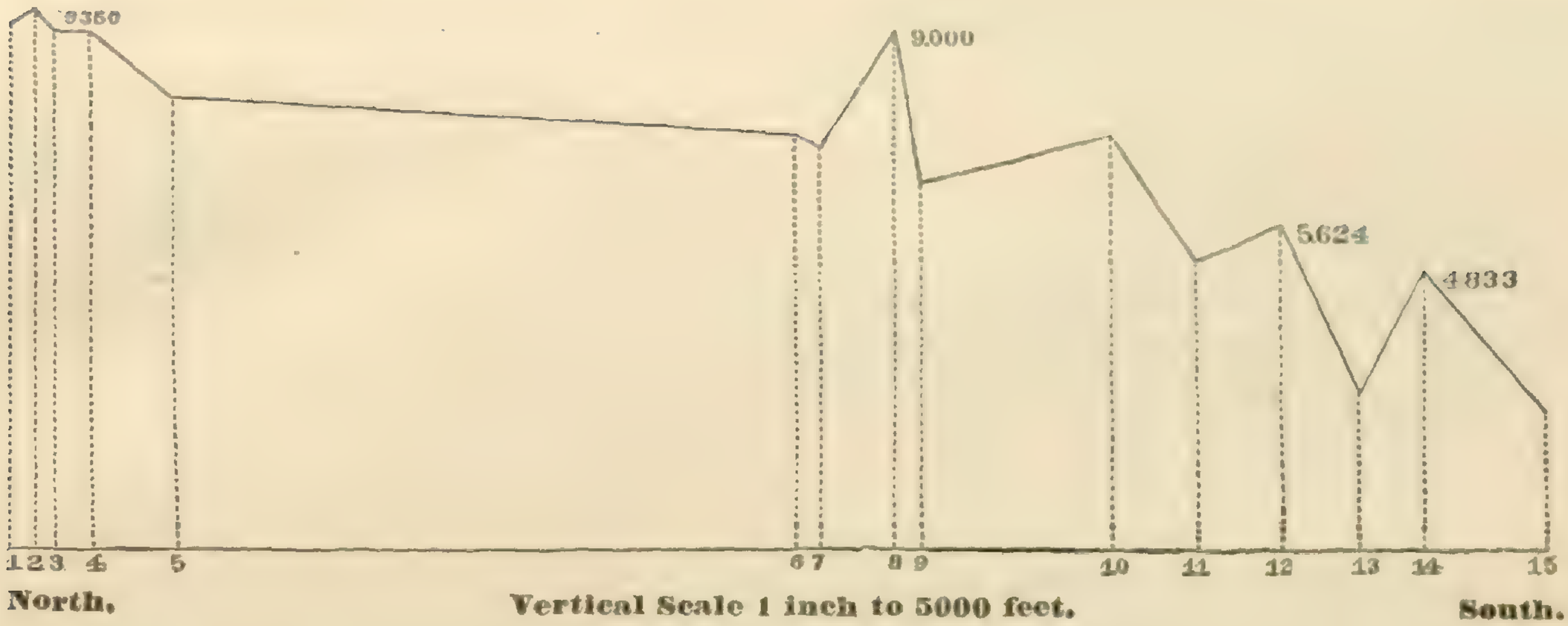
On the limestone rocks near Camp Bowie were *Cevallia sinuata* and *Macrosiphonia brachysiphon*, plants that we found to be by no means common. The *Artemisias* no longer formed the predominant feature of the plains landscape, as they had north of the Mogollon Mesa.

The immense stretch of plain from Camp Grant south, gradually becomes lower, until at Tucson it is but 2,400 feet above the sea. This plain as far as the San Pedro—say thirty-five miles north of Tucson (though, as before stated, in the main dry)—is covered with a luxuriant growth of grasses of nutritious character, wherever, as at Sulphur Spring, moisture is found in sufficient quantity in the soil. The immediate slopes of the San Pedro Valley are densely covered with *Atriplex*, *Sarcobatus*, *Suæda*, etc., while the malarial cursed flats along the river produce heavy crops of the ordinary cereal grains and garden vegetables. Thence to Tucson the country becomes more sandy, and even the *Chenopodiaceæ* give way largely to *Larrea* and various species of *Cactaceæ*.

From Tucson south the plain again rises until at Tubac it is again at least 3,000 feet, and east of the Santa Rita Mountains Old Camp Crittenden stands at an elevation of 4,749 feet. Here we leave the area of the Colorado River drainage, and enter another, sloping toward Mexico.

To generalize: we may say that from the Gila south almost to the Sonora line (along our route of travel), the country may be regarded as a plain with a gradual slope to the south, more or less barren and dry save along the river-banks, and in the immediate vicinity of springs; with the Pinaleño, Caliuro, Santa Catalina, and Chiricahua Ranges, and Dragoon and Santa Rita Mountains rising above the general level to a height of from 6,000 to 10,400 feet, the middle altitudes or mesas shading off into plains below and leading to mountain elevations above, with in neither case a clear line of demarcation between.

Indeed, we may go a step further and consider the entire country from South Park south to the Mexican line as a series of continental swells and depressions, illustrating still this southward slope.



In the above profile, vertical proportions only are closely observed. The southward slope is well made out. I have taken, so far as possible, representative altitudes.

1. South Park, on Platte River, Colorado, altitude 9,000 feet. 2. Trout Creek Divide, 9,350 feet (approximate). 3. Granite on Arkansas River, 8,883 feet. 4. Puncho Pass, 8,945 feet. 5. Saguache, on the head of the Rio Grande, 7,723 feet. 6. Bacon Spring, near Fort Wingate, New Mexico, 7,189 feet. 7. Fort Wingate, 6,982 feet. 8. Zuñi Mountains, rather a plateau than mountain-range, with an altitude of seldom, if ever, over 9,000 feet. 9. Zuñi, on the head of Zuñi River, 6,355 feet. 10. Willow Spring, 7,195 feet. 11. Camp Apache, 5,000 feet. 12. Tanks south of Camp Apache, 5,624 feet. 13. Gila River, 18 miles east of San Cárlos, 2,769 feet. 14. Camp Grant, 4,833 feet. 15. Tucson, 2,400 feet (approximate).

Of course, as a rule, along any given latitude there would be an eastern or a western slope also, as this line is not far from the meridian of the continental axis. An absolutely north and south line would give somewhat different figures, but would nevertheless illustrate the same truth.

Intimately connected with this slope of the continent to the south is the geographical distribution of the forest growth. It appears that the one factor of all others in the problem as to what shall be assigned as the lowest limit of timber, is the lowest point on the plain to which sufficient moisture

shall reach. Hence it does not surprise one to find the lowest limit of Coniferous vegetation ranging somewhat in this manner as one goes south:

	Feet.
South Park, Colorado	9,000
Saguache, Colorado (Piñon)	7,500
Santa Fé, New Mexico (Piñon)	7,100
Fort Wingate, New Mexico (Piñon)	7,000
Mogollon Mesa, Arizona (*Pinus ponderosa*)	6,500
Mogollon Mesa, Arizona (Oak)	6,200
Camp Grant, Arizona (Oak)	5,000
Camp Grant, Arizona (*Pinus ponderosa*)	6,500
Camp Crittenden, Southern Arizona (Oak)	4,749
Camp Crittenden, Southern Arizona (*Pinus ponderosa*)	5,500

In other words, where the plain breaks up into a well-defined mountain range or peak which is well watered, the timber begins just above the limit of the plain.

The upper limit of forest growth, or, as it is called, "timber-line," is less clearly defined. Dr. Engelmann has clearly pointed out, in "The Transactions of the Saint Louis Academy of Science" for 1862, p. 129, that near Denver it begins just at about the altitude it disappears in Alpine Europe; in other words, that it ascends in our Rocky Mountain Range about as high above the great plain out of which these mountains rise as it does on the Alps above the ocean level; and the conclusion appears clear that this plain receives the heat freely during the day, and its dry air allowing as ready a radiation of it at night, it (the plain) becomes the furnace whose heat is to carry the timber to so unusual an altitude.

Dr. Engelmann further notes that the popular opinion that this upper limit is carried to greater altitudes as we go south is not correct The following table may throw some further light upon his statements.

The upper limit of trees averages between—

Latitude 40–41° north, 7 peaks	11,132+
Latitude 39–40° north, 15 peaks	11,636
Latitude 38–39° north, 6 peaks	11,729
Latitude 37–38° north, 2 peaks	10,625
San Francisco Mountains, 35–36°, latitude north	11,547
*Sierra Blanca, Arizona, 33–34°, latitude north	11,100!!

*A portion of the material for this table I have obtained from Mr. Gannett's admirable "List of Elevations"—a paper of great labor and great value.

The fact here is apparent that between 33–34° it is actually lower than between 40–41°. Even though this be but a single isolated fact, the evidence that there has been some crudeness of observation would be further confirmed by the fact that the same table shows between latitudes 37–38° it reaches so low as 10,625 feet. One probable source of error in the above table appears from some observations kindly furnished me by Mr. Francis Klett. Thus, on Meadow Mountain (California), timber-line on the northern side was 11,200 feet, and on the southern, 12,000 feet. A difference of 800 feet, actually observed (on a mountain isolated from any great radiating surface, and one of a knot of peaks) between northern and southern slopes, should lead to more specific statements as to the circumstances under which observations are taken.

However, eliminating such exceptional cases as Sierra Blanca, Colorado, 10,410 feet, on the one hand, and La Plata Mountain, Colorado, 12,080 feet on the other, we may fairly infer these remaining thirty peaks were evenly enough divided as to the exposure, etc., to give us an approximation to the truth, and it would then even confirm Dr. Engelmann's statement that there is little or no increase of altitude in timber-line toward the equator, in our western hemisphere, south of the 41st parallel of north latitude.

As to the agricultural prospects of Arizona and New Mexico, we may safely venture on two assertions: first, that in neither of these Territories have we reached anything like the real possibilities of the soil and climate; second, that in both of them there will always (so long, at least, as the present climate endures) be an enormous percentage of waste land so far as raising crops are concerned; of this, much may be made available for grazing purposes, and the remainder will, from its want of water, always be worthless.

The Valley of the Rio Grande, from Loma, in Colorado, south, may be regarded as one continuous agricultural area, unpromising in appearance, but rich in the elements of vegetable life. Throughout its entire length, the cereals may be produced, and south of Santa Fé such fruits as grapes and apricots yield an abundant crop. The ordinary garden vegetables do well. This is, however, a mere strip, for the adjacent hills are at once assigned to the division of sage-brush deserts. Like the Valley of the Nile,

that of the Rio Grande receives its fertilizing in the frequent overflows to which it is subject, and in the mud carried suspended in the water used for irrigating. But unlike the Valley of the Nile, the overflow can hardly be called periodic. Dr. Oscar Loew has furnished the means of a comparison in his table, vol. iii, page 578:

	Rio Grande Mud.	Nile Mud. (Analysis of Horner.)
Potassa	1.784	0.473
Soda	0.795	0.533
Lime	1.751	1.901
Carbonate of lime	5.190	3.717
Magnesia	0.181	0.762
Oxide of iron Alumina	14.890	31.870
Silicic acid	70.010	54.585
Sulphate of lime	Trace	0.245
Phosphoric acid	0.092	Not determined.
Water and trace of organic matter	5.012	5.701
	99.705	99.818

The comparison shows, as Dr. Loew indicates, more potassa for the Rio Grande mud, but less phosphoric acid, than the mud of the Nile, whilst the Nile mud has a greater absorptive power for moisture than the Rio Grande, because of its greater quantity of hydrated oxide of iron. Except the enriching material thus conveyed, such long tilled lands as those of the older Indian pueblos have had no other fertilizer. And this fact confirms Dr. Loew's statement that the water is the all-sufficient source of supply.

In other localities, as the one he cites, three miles north of Silver City (p. 579), he attributes the success in raising corn to a moist subsoil (water being reached in 16 feet) and deep planting of the seed. But in Southern Colorado, in the San Luis Valley, where water is reached at a much less depth, irrigation is still found requisite.

The Valley of the Colorado Chiquito, though now hardly under the domain of agriculture, might be expected to produce large crops of grain, fruit, and vegetables when once water is furnished by irrigation.*

Indeed, at the foot of the Mogollon Mesa, and for some distance up the

* I allude here to the upper portion of this valley. I have no personal knowledge of its lower part.

slopes, we may infer that the condensation of moisture by the higher peaks might make it possible to avoid the necessity for irrigation. Timber is close at hand.

Salt River Valley is known to produce well, but the fact of there being no market for the crops has driven many of the settlers out.

The Gila Valley proper, though intensely hot, furnishes many instances of good return for labor.

The San Pedro Valley has already thousands of acres under cultivation, and produces good crops of barley and corn.

The Sanoita Valley, on the southern border of the Territory, though it has some land which may be irrigated and which is of surpassing fertility, must be regarded as rather a grazing than a farming region. It is well grassed, and has timber close at hand. This (as also the San Pedro) has the unfortunate reputation of being most unhealthy regions. The fact, however, is that the endemic diseases are such as give a low rate of mortality, and may be readily prevented. It is fair to make the statement that neither are now worse than were Indiana or Illinois a few years ago.

The region of the San Francisco Mountains is said by Dr. Loew to be well watered, fertile, and suitable for farming homes. He adds: The "soil is comparatively very rich in phosphoric acid, and therefore most excellent for grain and corn; for beans, peas, and lentils an addition of gypsum would be an improvement, these requiring more sulphur."

It is now well proven that almost all the elements of plant life must pass through the roots and thence ascend to the leaves to undergo elaboration previous to the final acts of metastasis. Hence it follows that under the dry air and high temperature, where water is given, the processes of plant life must be very active, and that, (as in most of this region) where abundant food is supplied, and of proper quality, either directly from the soil or by the water used in irrigating, or by both, enormous returns may be anticipated. Facts do not controvert the conclusion, as a comparison of the yield, per acre, of cereals and of garden vegetables, between say Kansas or Nebraska (or even an older, better tilled State), and some portions of Arizona, New Mexico, or California, would show.

The indigenous grasses, though somewhat localized in their distribu-

tion, and seldom forming a dense sward, are exceedingly nutritious, and stock will make long marches having no other food. Among them we may especially allude to the various "bunch-grasses" of Colorado, *i. e.*, *Eriocoma*, *Festuca*, and *Poa*, and more notably still the *Bouteloues* of Southern Arizona, where, without much distinction, all are called "grama".

I am here again indebted to the researches of Dr. Loew for the following analyses of grasses. See Lieutenant Wheeler's Annual Report to the Chief of Engineers, 1875, page 138.

FESTUCA OVINA, from an altitude of 10,000 feet, on the Jemez Mountains, New Mexico:

Water	12.3
Ash	5.4
Fibre	30.2
Fat	1.5
Aqueous extract (of which 0.07 is sugar)	12.2
Sugar, formed on digestion with dilute hydrochloric acid	10.8
Extracted by potassa, and loss	27.6
	100.0

BOUTELOUA OLIGOSTACHYA, collected September 7 in the Abiquiu Mountains, New Mexico, at an altitude of 7,500 feet:

Water	12.0
Ash	7.8
Fibre	24.4
Fat	2.4
Aqueous extract (0.08 sugar)	14.1
Sugar, formed on digestion with dilute hydrochloric acid	22.2
Extracted by dilute potassa, and loss	17.1
	100.0

BOUTELOUA HIRSUTA, collected near Las Vegas, New Mexico, November 16, at an altitude of 6,500 feet; it was dead and dry, but without loss of nutritive properties:

Water	13.0
Ash	6.5
Fibre	19.1
Fat	2.1
Aqueous extract (0.09 sugar)	13.8
Sugar, formed on digestion with dilute hydrochloric acid	26.3
Extracted by dilute potassa, and loss	19.2
	100.0

It may not be considered out of place to give some consideration to the forestry of this and the Colorado region. The subject is now one of growing interest, and it is not improbable will before long become a subject for legislation.

The impression gained by a resident on the eastern side of our domain, from what he sees, or has been taught of the region about him, is, that North America, from ocean to ocean, is practically a timber area. True, he has heard of the Western plains and prairies and deserts, but that these treeless stretches are actually larger by far than the timber areas does not occur to him, nor does it appear probable to him that in the near future want of timber can become a serious drawback to our national prosperity.

This is one standpoint from which the subject may be considered. Another is the influence of extensive forests upon the climate. Do they increase the rainfall? or do they simply aid in obtaining better results with less damage from what does fall? How far can we use them to reclaim waste areas? Will it pay?

From the following table we may see the proportionate area of wooded to open land in our "West" that fairly comes within the scope of this report:

Territory or State.	Total area in acres.	Area of wood-land in acres.
Colorado	66,880,000	6,667,469
Utah	54,065,043	5,391,883
New Mexico	77,568,640	4,710,388
Arizona	72,906,240	4,373,065
Nevada	71,737,600	3,589,869
California	120,947,840	9,604,607
Texas	175,587,840	46,960,123
Kansas	52,043,520	2,954,751
Nebraska	48,636,800	2,541,524*

This table will serve at least to show how small in proportion to the open area is that of the timber in our Western domain. Professor Brewer remarks, in his Analysis of our Forest Resources (in Walker's Statistical Atlas, and afterward republished in the Agricultural Report for 1875, p. 352): "It is possible to cross the continent from the Pacific Ocean to the

* Report of the Commissioner of Agriculture for 1875, p. 247.

Gulf of Mexico without passing through a forest five miles in extent, or large enough to be indicated on the map." Then, again: "The woodlands of the East are separated from those of the West by a broad treeless plain from six to fifteen degrees wide." It may be worth noting also that there is in these States and Territories an absolute want of a hard wood like our Eastern hickory, and almost no *large growth of oak, such as we find here.* The statement has been made that in the State of Texas there is an area four times as large as the State of Pennsylvania, over which there is neither a tree nor a shrub.* Making allowance for the extravagance of this assertion, it is sufficient to indicate how wide are its treeless areas.

In view, then, of the acknowledged fact that in our older and more densely populated States we have an impending dearth of timber, would not a wise political economy endeavor to obviate such a result in our Western regions? Tree destruction began with us as a necessity, but it has been matured into an instinct. With the comparatively small quantity of timber actually growing in the Western Territories, with the certainty of a demand for an enormous quantity as these regions are opened up, does it not appear that some restriction should be imposed on the almost ruthless destruction of the forests on the public domain? Take for example the Santa Rita Mountains in Southern Arizona, from which probably all the available timber will be removed before the real current of a steady and substantial immigration shall have set into the neighboring Sanoita Valley. Or the instance furnished by Kern County in California might be still more in point, as its speedy settlement is sure. Yet, actually in advance of this, what timber there is, is actually being swept away. Mr. John Muir's paper on the Post-Glacial History of the *Sequoia gigantea*, in the Proceedings of the American Association for the Advancement of Science, 1876, page 252, puts the case very strongly. He tells us that "one sawmill on the Kaweah cut over 2,000,000 feet of 'big tree' lumber last season" (1875), "and that in these milling operations waste far exceeds use, for after the choice young manageable trees on any given spot have been felled, the woods are fired to clear the ground of limbs and refuse with reference to further operations, and of course most of the seedlings and saplings are destroyed." Then, too, come the destruc-

* The entire area of Texas being less than six times that of Pennsylvania.

tive fires purposely started to clear away the underbrush that the bands of sheep may be more readily cared for and grazed.

It can hardly be out of place to contrast such a wilful waste with the wise provision of the Swedish law (enacted prior to 1647), which compels the "private owner to plant and protect from cattle *two timber trees for every one cut.*"

It may fairly become a question as to whether it would not be money well invested if the general and state governments were to anticipate future wants and plant extensive areas of our Western domain with hardy and rapidly growing timber trees. It appears from the latest statistical information available that already the States and Territories comprising our domain are in the percentage of timber area to the entire surface actually below Norway, Sweden, Russia, and Germany. In view of what we have anticipated in the way of increased population, this is rather an alarming statement.

Will tree planting succeed on our open Western lands? What trees can be grown, and will they add to our material resources? Here we can only appeal to facts. We must premise by saying that to the young trees planted, care and protection must be accorded. In other words, they must be regarded as a *crop* to be protected from cattle and have the ground prepared for their reception. This being granted, we may fairly expect that over a large part of our domain we should have results something like those furnished by Mr. Longstreth, forester to the Atchison, Topeka and Santa Fé Railroad. After three years' growing, the following percentage of each survived and was growing well:

	Per cent.
Silver-maple, one year old when planted	50
Box-elder, one year old when planted	60
Honey-locust, one year old when planted	95
Catalpa, one year old when planted	100
Ailanthus, one year old when planted	100
American elm, one year old when planted	90

The same authority furnishes many other statistics, but as they are not founded on any longer experience, I omit all save those from the fourth station in Kansas, at Spearville, 283 miles west of the eastern line of the State. The elevation is 2,480 feet, and is high upland prairie, and known

as Dry Ridge. He adds that the growth was slower, but that quite as many of the trees lived. We may in many respects consider this a crucial test. After three years' growth, the following percentages were alive and thriving:

	Per cent.
Silver-maple, one year old when planted	90
Box-elder, one year old when planted	80
Honey-locust, one year old when planted	100
Ailanthus, one year old when planted	100

Statistics from New Mexico and Arizona are meagre in the extreme. There is no doubt, however, but that thousands of trees of the indigenous cottonwoods, and of box-elder, Ailanthus, and China-tree, could be grown along the irrigating ditches and in other moist places: enough to raise the farmer in a few years beyond any immediate want for his most needed woods, and to *largely* spare the drain on the pine forests that cover the remoter mountains. It is in the highest degree probable that some of the various Australian trees, now being so successfully cultivated in California, especially some of the *Eucalyptus* species, could be made to do well in the warmer valleys of New Mexico and the warmer ones in Arizona where water may be had. These trees, as rapid growers, and as making good lumber, are of great value.

We must still regard the problem a mooted one as to whether or not forests actually increase the rainfall of any region. The probabilities, however, appear to be against the supposition that they do. There can be, I think, no reasonable doubt but that they aid in obtaining greater benefits from what does fall. I am aware of recent observations in France which would appear to make even this doubtful, but I think the facts are so well established here that they may be regarded as above suspicion. The paper by Mr. Muir, already quoted, gives a striking illustration of this in the case of the *Sequoia gigantea*, and other instances not less apt might be furnished. Mr. Cooper, of Santa Barbara, has elaborated at some length a plan for obtaining larger results in agriculture from the same quantity of water by making the shade of the eucalyptus diminish the excessive evaporation of the water. The details of this will be considered elsewhere.*

* It may be considered a question as to whether the water taken up by the roots would not equal or exceed that saved from evaporation.

Of course, the question as to how long we must wait for these trees to develop into timber is another element of the problem, and this will vary with the particular species of tree. In California, we might expect the blue gum would in five years be large enough to use as fuel and as fencing, but we could hardly expect it to have sufficient girth to answer most commercial purposes inside of thirty years. Emerson, in his "Trees and Shrubs Growing Naturally in the Forests of Massachusetts", instances a white pine planted near Paris thirty years before, that had attained a diameter of 3 feet and was 80 feet high. Marsh, in "Man and Nature", p. 274, tells of another that in thirty-six years had grown to 25 inches in diameter. The Ailanthus, American elm, and chestnut may be given as illustrations of rapid growth. Either of these would in thirty years produce good timber.

The Nevada and Utah districts have been so thoroughly elaborated by Mr. Watson in Vol. V. of King's Reports, that no further statements concerning them are requisite. There is also an able article by Dr. W. J. Hoffman on the distribution of vegetation in portions of Nevada and Arizona, in the American Naturalist for June, 1877. Dr. Hoffman's former connection with this Survey, his opportunities for observation, and his zeal in botany, confer a special value on his paper.

I am indebted to my friend Dr. George Martin, of West Chester, Pa., for the following important note:

Mean annual rainfall in Philadelphia for 43 years, *i. e.*, from 1825 to 1867, inclusive ..... 44.02 inches.
Thus, mean for the first series, 21½ years, of this period ..... 42.12 inches.
For the second series of the above period ..... 45.86 inches.
Taken from Smithsonian Tables (May, 1872).

Mean annual rainfall in West Chester, Pa., for 18 years, *i. e.*, from 1860 to 1877, inclusive ..... 51.18 inches.
Thus, mean for the first series of 9 years of above period ..... 50.16 inches.
For the second series of same period ..... 52.20 inches.
Taken from Register of Dr. Jesse C. Green.

All will admit that a large body of woodland has been cleared during these periods in the vicinity of both these stations, and yet there has been an increase in precipitation.

It will not do to compare the observations taken at West Chester with those of Philadelphia unless the whole series could be taken, as the local influences and errors of instruments have not been eliminated. Each, however, is complete and conclusive in itself.

CHAPTER III.

NOTES

ON

ECONOMIC BOTANY.

BY

J. T. ROTHROCK,

SURGEON AND BOTANIST TO THE EXPEDITIONS OF 1873, 1874, AND 1875.

CHAPTER III.

NOTES ON ECONOMIC BOTANY.

BERBERIS AQUIFOLIUM, Pursh. *Oregon Grape.*—According to Dr. Engelman, this is also called in Colorado, MOUNTAIN GRAPE, and the juice when fermented makes, on the addition of sugar, a palatable and wholesome wine.

CAULANTHUS CRASSICAULIS, Watson. *Wild Cabbage.*—Sometimes used as food, when a better substitute cannot be found.

FREMONTIA CALIFORNICA, Torr. *California Slippery Elm.*—Though totally unlike Eastern slippery elm in its botanical characteristics, the inner bark develops large quantities of mucilage when wet; in this respect sharing the peculiar properties of some other members of the order. Used in California to make poultices, etc.

ERODIUM CICUTARIUM, L. Her. *Alfilaria,* Pin Clover, Pin Grass.*—A valuable forage in California, Arizona, and New Mexico; eagerly eaten by the stock. Gay (*Historia de Chile, Botanica, tom. prim p.* 388) speaks of both this and E. MOSCHATUM as among the best natural forage-plants of Chili, and believes them to be indigenous. It is strange that little or nothing is said concerning their value in this respect in European works. I can only account for this, that on the more constantly green swards of the East stock does not seize upon it with the same avidity that it does in a country where it remains green after all else is dead, and grows where nothing else will flourish.

LARREA MEXICANA, Moricand. *Creosote-bush.*—Common from Western Texas to Kern County, California, and southward into Mexico. Dr. Loew's examination proves that "the reddish-brown exudate on the branches" will yield a red coloring-matter showing all the reactions of cochineal.

"The alcoholic extract of the leaves on evaporation yields a greenish-brown residue of a specific and somewhat disagreeable odor, more strongly perceptible on boiling the extract with water. This residue is only to a

* Commonly spelled as above, but the correct orthography appears to be *Alfilerillo.*

small extent soluble in water, and the solution has an acid reaction. It yields a light yellow precipitate with acetate of lead. The part of the alcoholic extract that is insoluble in water is easily soluble in alkalies. It also dissolves in nitric acid at a moderate heat, whereby oxydation takes place. On addition of water, a yellow, brittle mass is precipitated." The Mexicans are said to use an infusion of the leaves for bathing in, in rheumatic affections. See Vol. III, Wheeler's Reports, pp. 608–9.

RHUS DIVERSILOBA, T. & G. *Poison Oak, Yeara.*—Much like our poison oak of the Eastern States. Common on the Pacific coast. For remedy see *Grindelia robusta.*

NEGUNDO ACEROIDES, Mœnch. *Box-Elder.*—Bearing in mind the great success of the experiments with this tree in Kansas and Nebraska, and its wide range over the more arid areas of our Southwest, it may be well to remember it in further attempts at tree culture. Though hardly to be considered as a valuable timber, it may fairly be reckoned on the shade and fuel list, and fairly associated in this respect with the following:

SCHINUS MOLLE, Linn., from Mexico and South America.—Now grown in Southern California under the name of Pepper Tree and Chili Pepper.

PROSOPIS JULIFLORA, DC. *Mesquit. Algaroba* of the Mexicans.—Grows from Southeastern California east to Texas, where it attains the tree size, and forms dense thickets; extends south into South America. The gum exuding from this tree closely resembles gum arabic in appearance and in its properties, and may some day become an important article in trade. The pods while yet in pulpy condition are a valuable forage, eagerly eaten by animals, and on which they actually thrive while making hard marches. The beans contain thirty per cent. of grape-sugar. Dr. Loew asserts that the Comanche Indians prepare an alcoholic beverage from them. As a fuel it ranks with the hickory of the Eastern States, and the charcoal made from it is said by Dr. Loew to be of the best quality for metallurgical and smelting purposes. Besides this species, there is another, hardly less useful, *i. e.*, *P. pubescens*, Benth., the SCREW-BEAN, the pods of which are ground into flour by the Indians. The wood of both species is of great value in some of the arts.

OXYTROPIS LAMBERTI,* Pursh, in Colorado; and ASTRAGALUS HORNII and ASTRAGALUS LENTIGINOSUS var. FREMONTII, in California, are known as loco-plants. The term *loco*, simply meaning foolish, is applied because of the peculiar form of dementia induced in the animals that are in the habit of eating the plant. In Arizona, I was told that *Hosackia Purshiana* produces effects similar to the above plants, but I have no certain knowledge concerning it.

Whether the animals (horses chiefly) begin to eat the plant from necessity (which is not likely) or from choice, I am unable to say. Certain it is, however, that once commenced, they continue it, passing through temporary intoxication to a complete nervous and muscular wreck in the later stages, when it has developed into a fully marked disease, which terminates in death from starvation or inability to digest a more nourishing food. The animal toward the last becomes stupid or wild, or even vicious, or again acting as though attacked with "blind staggers".

Dr. Horatio Wood, jr., has recently brought to light (Phila. Med. Times, vol. vii, p. 510) a new alkaloid in *Sophora speciosa*, Benth. This he names *sophoria*. In its action it resembles Calabar bean. This alkaloid is a spinal sedative, producing death through the respiration. One-twentieth of a grain of an impure specimen of this alkaloid produced a profound sleep, lasting many hours, in a half-grown cat. Mr. Bellinger, of Texas, states that the Indians near San Antonio use it as an intoxicant, half a bean producing "delirious exhilaration followed by a sleep which lasts two or three days"; and it is asserted that a whole bean would kill a man.

Mr. Lemmon has noted *Astragalus Mortoni* "as a deadly sheep poison" in California. See Brewer & Watson, Bot. Cal., vol. i, p. 155.

This order (*Leguminosæ*) was, until lately, regarded as on the whole rather innocuous, but recent discoveries have brought to light quite a number of plants of bad repute.

CERCOCARPUS LEDIFOLIUS, Nutt. *Mountain Mahogany.*—Growing in the mountains of California to be a tree twenty feet or more high. The wood when dry is dark-colored and excessively hard. It may yet be made available in the arts, as the wood takes a beautiful polish.

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* The alcoholic extract of this plant failed, when hypodermically injected by Dr. H. C. Wood, to produce poisonous symptoms in the lower animals. He hence concludes it is a mistake to regard it as one of the "loco plants".

EUCALYPTUS GLOBULUS, Labill. *Australian Blue Gum.*—Now planted by thousands in Southern California. This tree is of very rapid growth, and makes withal a solid, close-grained, enduring timber. Mr. Cooper, of Santa Barbara, estimates the gain in growing this to be greater than that derived from the cereals. As to its value from a medicinal standpoint, I am free to say it has in every instance disappointed me in its anti-periodic effects, I do not regard it (though I have used it heroically) as in any sense the peer of the preparations derived from cinchona. It is, however, not improbable that the enormous evaporation from the surfaces of the leaves and young shoots may be a means of improving the sanitary condition of a moist, boggy, ague-cursed area, when the trees are planted in masses, but the idea that any mere cordon of trees around a home would protect it appears improbable, not to say preposterous. However, I am bound to say we are yet without sufficient data on which to base an absolute conclusion. In such regions as the Sanoita Valley, Cienega, or San Pedro in Southern Arizona, it would doubtless flourish, and a few years hence be of immense value as a timber tree. The Southern Rio Grande Valley offers another suitable spot for its introduction. While this species will not endure cold weather, it is to be remembered that there are others of the genus that are hardier and almost as valuable as timber. These would probably be well worth a trial in Arizona and New Mexico.

MENTZELIA ALBICAULIS, Dougl.—The Indians in Southeastern California pound up the seeds of this, making thus one of their forms of piñoli. Sometimes also used by them in a kind of cake.

CUCURBITA PERENNIS, Gray. *Chili Cojote*, and *Calabazilla* in Southern California.—Brewer & Watson assert, in Fl. Cal. p. 239, "that the pulp of the green fruit is used with soap to remove stains from clothing, and that the macerated root is used as a remedy for piles, and the seeds are eaten by the Indians."

CYMOPTERIS FENDLERI, Gray. *Chimaja* of New Mexico.—This plant emits, when in decoction, a peculiarly strong and pleasant odor, not unlike *C. anisatus*, which it closely resembles. The residents in and about Santa Fé are in the habit of using this as the chief ingredient, after whisky, to form a warming, stomachic "bitters", which is immensely popular, as anything is likely

to be which improves in any way the whisky of the region. A less objectionable use is made of it by using it as a stuffing in a leg of roast mutton, the whole mass of which it permeates with its pleasant flavor. It is not unlikely that ere long this plant will be made the basis of another quack constitutional invigorator. There is probably no doubt of its being a good carminative, and it may also prove to a certain extent tonic.

Osha.—This root, so well known in and around Santa Fé, is derived from an unknown plant, probably a *Peucedanum*. Dr. Herman Haupt, jr., has furnished a careful analysis of the root in the Am. Jour. Pharm. Aug. 1, 1873, p. 347, in which he concludes that his results indicate the presence of "an acid not identical with angelic acid; it appears to be a new acid hitherto unknown, and to deserve to be distinguished by the name of Oshaic acid. From 100 grains of the air-dried root 8 grains of ashes were obtained, containing iron, aluminum, sodium, and potassium." It is probably this plant to which Dr. Loew alludes, under name of *Angelica*, in Vol. III, Wheeler's Reports, p. 608. It is alleged to have tonic properties. Better specimens are desirable, as it is altogether probable the plant is an old, well-known species. It may have remedial powers that will stand investigation.

According to Messrs. Brewer and Watson, in Flora of California, the roots of *Carum Gairdneri* and *C. Kelloggii* are a prominent article of food among the California Indians, as are also the roots of most of the species of *Cymopterus* and *Peucedanum*.

Eupatorium Berlandieri, DC.—A specimen of this was handed me at the Chiricahua Agency in Southern Arizona, and the statement made that the Apache Indians there were in the habit of using it as a substitute for tobacco. At first I was disposed to accept the statement *cum grano salis*, but have since discovered that other species are elsewhere used in a like manner. On trial, I find the smoke devoid of any marked flavor, but rather acrid when passed through the nostrils. It also appears to have some more marked property in a very slight degree, as indicated by a gentle nervous tremor induced in smoking. The dry leaves when rubbed in the hand emit faintly a rather resinous odor. There is no doubt but that it would be quite as pleasant and satisfactory as much of the drugged, cheap tobacco now on the market.

GRINDELIA ROBUSTA, Nutt. *Gum Plant* of California.—This plant has recently come into notice as a remedy in poisoning from *Rhus diversiloba* (Poison Oak of California). So far as I know, it has not been tested on our Eastern poison oak, which is another species, and for which the fluid extract of Serpentaria, as advised by Dr. Henry Hartshorne, acts almost as a specific, when applied locally. The resinous exudation on the leaves of the *Grindelia* is applied in California, or it has been used in the form of a tincture. Concerning the wide range of usefulness anticipated in medicine for *Grindelia*, I am in the highest degree skeptical.

BIGELOVIA VENETA, Gray. "*Damiana*" in Northern Mexico.—The plant is found just outside our borders, and may reach within our domain. I introduce it here because it is so closely related to *B. Menziesii*, which extends abundantly from San Diego to Arizona, and as far north as Utah, as to be by some regarded as identical. Concerning Damiana, or, as it is often called, *Yerba anti-rheumatica*, we have of late heard much in medical journals as an aphrodisiac. There are a number of other claimants for the name Damiana. Of this one, I am free to confess I consider it utterly worthless as a remedial agent. The resinous exudation on it somewhat resembles that found on *Grindelia robusta*, and was probably the means of attracting attention to it.

Pectis angustifolia and *P. papposa* appear to have been generally noticed because of their peculiar odor of lemons. Indeed, Dr. Loew suggests that in the former this might be turned to commercial account.

ARTEMISIA.—Several Western species have been reputed as of use in ague and mountain fever by the prospectors of the West. They are used in decoction. *I am not prepared to vouch for their efficacy, however.* Some species are said to "owe to their aroma and bitterness decidedly stimulating properties." See Le Maout and Decaisne, English edition, p. 505. The current ideas concerning some of our Eastern species would go for something in confirming the estimate placed on the Western ones.

ASCLEPIAS LEUCOPHYLLA, Engelm, var. OBTUSA, Gray. "*Milkweed.*"—Has about Fort Tejon, California, the reputation of "locoing" the sheep. How well merited this is I am unable to say.

ERIODICTYON.—In California I believe the name "Yerba santa" is used

for both *E. tomentosum* and *glutinosum* of Bentham. An infusion of the leaves in whisky or other alcoholic liquor is reckoned almost a panacea by the native population. Precise clinical trial is yet needed to determine its true value.

ERITRICHIUM FULVUM, A. DC.—I have received from my friend Mr. William L. Kennedy, of Fort Tejon, California, abundant specimens of this plant, collected in white paper, which it had stained completely with a bright orange-red color. Mr. Kennedy accompanied the specimens with the remark that "the fresh root and leaves are used by the squaws to paint their faces, and that the color is not inferior to the finest rouge." From the abundance of the juice, as manifested by the stained paper in which I received the plants, I infer that the plant might be turned to some commercial account. The coloring matter is not confined to this species.

CUSCUTA RACEMOSA, Mart. *Alfalfa Dodder.*—Coming from Chili, and introduced thence into Europe; as early as 1874 was discovered in California, and means indicated then for its destruction by Professor Thurber in the American Agriculturist. Since then it has been doing extensive damage to the Alfalfa crop, as we hear from Dr. Engelmann in the Botanical Gazette for January, 1877, p. 69. An immunity from this pest would be cheaply purchased by early and frequent examination of the Alfalfa fields and the destruction of the plants *infected* before seeds can be matured, as advised by Dr. Engelmann. It is also worthy of consideration as to whether it would not be as well to prevent importation of Alfalfa from Chili, or, what is the same thing, lucerne from Europe, in view of the likelihood of introducing still further this unwelcome intruder from places where it has been so thoroughly established.*

NICOTIANA.—Various of the indigenous species of tobacco appear to

*CUSCUTA RACEMOSA.—In the January number of the Gazette, Dr. Engelmann gave a warning to the farmers who wished to cultivate the Alfalfa, or California clover, to beware of the dodder, *Cuscuta racemosa*, which had always accompanied it in Europe and California. The warning was sent throughout this region, to the county papers, but in spite of it all, seed-agents have succeeded in running in a great deal of Alfalfa seed. As a consequence, a short time ago, after the clover had started well, I began to receive specimens of the plant encircled by a "troublesome little vine", and everybody wanted to know what it was. It was the genuine *Cuscuta racemosa* in good flower and fruit, and it has come up in every Alfalfa field in this county. The agricultural editors of several widely circulated papers are recommending it, and doing what they can to bring this annoying parasite into our fields.—J. M. Coulter, Bot. Gaz. vol. 2, p. 136.

have been used by the native population past and present. Among them, however, is one of some interest from an archæological standpoint, *N. Clevelandi*, Gray, *Syn. Fl., vol. ii, part* 1, *p.* 242. This small and small-flowered species was found by me only in association with the shell heaps which occur so abundantly on the coast of Southern and Central California. Perhaps of all the remains of extinct races so richly furnished by that region, none were so common as the pipes, usually made of stone resembling serpentine, and in shape, as Dr. Yarrow has aptly remarked, like a cigar-holder. These pipes were seldom less than 6 inches long, and $1\frac{1}{4}$ inches in diameter at the larger end, and often much exceeded these measurements. The wing-bone of a pelican, cut to say 2 inches in length, was glued with the inevitable asphaltum into the smaller end as a mouth-piece. Uncomfortable as pipes of this size must have been in use, there is no doubt that they were much used, and there is hardly any doubt in my mind that the above named species of tobacco was the standard supply for them. I can only say, from some experience, that it is excessively strong.

Salvia Columbariæ, Benth., is the Chia of Southern and Central California. I abstract the following brief account I have given of it from the Botanical Bulletin:

"During the summer of 1875 my attention was called, while in Southern California, to a mealy preparation in popular use among the Indians, Mexicans, and prospectors. On inquiry, I found it was called 'Chia.' Further examination proved that it was furnished by the seeds of *Salvia Columbariæ*, Benth. The seeds are collected, roasted, and ground, in the native way, between two stones. This puts it in the condition in which I first saw it. It is used as a food by mixing it with water and enough sugar to suit the taste. It soon develops into a copious mucilaginous mass, several times the original bulk. The taste is somewhat suggestive of linseed meal. One soon acquires a fondness for it, and eats it rather in the way of a luxury than with any reference to the fact that it is exceedingly nutritious besides. It is in great demand among the knowing ones who have a desert to cross, or who expect to encounter a scarcity of water, and what there is, of bad quality. By preparing it so thin that it can be used as a drink, it seems to assuage thirst, to improve the taste of the water, and, in addition,

to lessen the quantity of water taken, which in hot countries is often so excessive as to produce serious illness. As a remedy it is invaluable, from its demulcent properties, in cases of gastro-intestinal disorders. It also holds a place among domestic remedies, for the same purpose that flaxseed occasionally does with us, *i. e.*, a grain of the seed is placed in the eye (where it gives no pain) to form a mucilage by means of which a foreign body may be removed from the organ. I have found it of great service as a poultice. As a matter of archæological interest, it may be noted that quantities of this seed were found buried in graves several hundred years old. This proves that the use of the seed reaches back into the remote past. Indeed, I find several allusions to the name Chia in the second volume of Bancroft's great work on the 'Native Races of the Pacific States,' pp. 232, 280, 347, 360. *Chianpinoli* appears to have been made by the so-called Aztec races from corn which was roasted and ground as the Chia was. Chia was, among the Nahua races of Ancient Mexico, as regularly cultivated as corn, and often used in connection with it. Indeed, it was one of the many kinds of meal in constant use, and which appear to have gone then, as now, under the generic name of pinoli."

ABRONIA FRAGRANS, Nutt.—The delicious perfume of the flowers of this plant suggests the inquiry as to whether it could not be utilized as a toilet adjunct. Specimen number 127 of the New Mexican collection, when taken at Agua Azule, was fairly loading the air with its matchless fragrance.

EUROTIA LANATA, Moq "*White Sage*," "*Winter Fat*."—Widely diffused through our Western Territories, and held in great repute as a winter forage; stock feeding on it actually gaining flesh when living on this plant, so unpromising in its appearance. It is noteworthy that most animals do not at first eat it from choice. Of this we had the strongest evidence furnished by mules taken from Missouri to Colorado. They would not touch it The Utah band, however, eagerly devoured it. Said by Mr. Watson to impart a disagreeable flavor to the meat of cattle fed upon it, and also asserted by the same authority to be used as a remedy in intermittents.

ANEMIOPSIS* CALIFORNICA, Hook. "*Yerba de Mansa*."—This plant, if we

* Spelled Anemopsis in Bot. Beech. p. 390: Anemiopsis in DC. Prod. vol. 16, pars 1, p. 237; where also in the index, as a footnote, the following occurs: "Anemopsis in Hook. et Arn. [Bot. Beech. l. c.], sed rectius, ex Anemia, *Anemiopsis* ut scripsit Endlicher."

may at all credit popular report, is well worthy of further investigation as a remedial agent. Unfortunately I have mislaid my notes, and can say now nothing more definite than that it is regarded as a diuretic, and is largely used in baths for rheumatic affections. It is rather unsafe to venture an opinion on its mere appearance; but, if I were to do so, I should say it would probably drop into that somewhat vague class of remedies known to physicians as alteratives.

EUPHORBIA.—The various prostrate species of this genus have, in the Southwest, a popular reputation as a remedy in bite of rattlesnakes, tarantulas, etc.; and, to meet the demand for it, a tincture is kept on hand in the shops. In absence of this (on the authority of Dr. George Thurber), the fresh leaves bruised, or the dry ones steeped in wine, are applied to the wound. These plants are there known as "*Yerba de la Golondrina*". While not wishing to cast discredit upon the remedy applied in this way (and that too after the venom has usually been taken into the general circulation), I can only say it is hard to understand how it could be of any service.

EPHEDRA ANTISYPHILITICA, C. A. Meyer. "*Canutillo*," "*Tepopote*," "*Whorehouse Tea.*"—The names, scientific and popular, might be regarded as sufficiently indicative of the alleged properties of the plant. The stems of the plant are largely used in decoction as a remedy in gonorrhœa. Precise clinical results are wanting to determine its real value. However, by common consent among the populace, and so far as I can learn from medical men of the region, it is of real service. Its close botanical relationship to the balsam-producing *Coniferæ* would appear to suggest that this too must contain a like product. This, however, is not confirmed by the careful analysis of Dr. Loew (Vol. III, Wheeler's Reports, pp. 611 and 612). The above-ground portion is there shown to yield an aqueous extract of "acid reaction, and an astringent taste, resembling that of tannin." No body resembling an organic base or alkaloid was found The filtrate of the aqueous solution proved the presence of tannin and tartaric acid. Pectin was also shown to be in the filtrate by the "jelly-like precipitate produced by the addition of alcohol." The tannin belongs to the glucosid group, furnishing sugar on treatment with acid and various other compounds, and, upon dry distillation, pyrogallic and carbonic acids. This tannin splits up into sugar "*and a red*

amorphous powder." The powder Dr. Loew considers quite a distinct body, which he names *ephedrin*, and to this he attributes (and probably correctly) its remedial properties. So concurrent is the testimony in favor of this plant that it is well worthy of a fair trial in hospital practice.

POPULUS TREMULOIDES, Michx. *American Aspen.*—Dr. Loew reports the bark of this tree to be used by the Indians in intermittent fever. It has long been more or less of a domestic remedy, and, indeed, of a certain class of practitioners, for this disease. It is not a little remarkable, however, that it should also be used by the Indians, and we can only account for the fact that it does possess some remedial power in this direction, which a "hit or miss" empiricism has led them to discover. Dr. Loew's analysis of the bark yields salicin and populin. The former was long ago in common use in intermittents. It is therefore probably slightly anti-periodic as well as tonic in its action.

AGAVE PALMERI and A. PARRYI. "*Mescal.*"—The admirable papers of Dr. Engelmann on this and on Yucca leave little for any one else to add. In hopes, however, of somewhat enlarging the circulation of what he and Dr. Loew have already brought out, I incorporate the leading facts here:

"The subterranean trunk of most (or all?) the Agaves contains, like that of Yuccas and many other plants of these families, a great deal of mucilage, which, mixed with water, has detergent properties to a considerable degree; these 'roots' and the whole plants thus used are known to the Mexicans by the name of 'Amole'."—*Engelmann, l. c.*

The leaves of all or nearly all the species abound in a coarse fibre, which has been utilized by the native population in making a cheap cordage. Mescal whisky is prepared by distillation from the juice which has been collected in the cavity formed by removal of the just starting flower-stem and the inner leaves. The quantity yielded is almost fabulous. This whisky contains a large percentage of alcohol, and it is said that it is impossible to adulterate it so that the adulteration cannot at once be detected in the taste. Hence it is hardly surprising that those who are "advised to take stimulants" take so kindly to "Mescal". Fresh from the still, it is even hotter than corn whisky equally new.

The unopened interior leaves forming a sort of head are taken by the

Indians, roasted several hours (without direct access of air?), and then eaten. The first effect is that of a laxative on those not accustomed to the food. Dr. Loew's analysis of the dried, uncooked young leaves revealed the fact that there was no starch present, not even a trace. Yet the sweet taste of the roasted Mescal was enough alone to suggest the presence of sugar. He discovered that exposure to heat alone, will cause it to yield grape-sugar in abundance. This also took place on application of cold water, and he remarks that it appeared impossible to separate the suspected new substance he had to deal with from the cellular tissue without simultaneous formation of grape-sugar. Further examination proved he had to do with a compound body, a glucosid and citric acid. This he names citro-glucosid. It differs from this class of bodies in this, that water alone can separate it into grape-sugar and citric acid; the compound never before having been found in nature or made in a laboratory. The flowering stalk when green is much resorted to by Indians and travellers to alleviate the suffering caused by the parched mouth; they take a section of the stem, say a foot long, and suck out the saccharine fluid, and afterward chew the interior pith or pulp. When dried, the stems are used to form covering for houses, before the mud is thrown on, which is to complete the roof.

In connection with what has been said of the strong fibre of Agave, it might be appropriate to mention that the *Dasylirium*, or *Bear's Grass*, of which there are several species in this same region, also produces more or less fibre that may yet be utilized.

Yucca baccata, Torr., along with other species of the same genus, is, like Agave, also known to the Mexicans as *Amole*, and the root used by them in washing. Dr. Loew has recently furnished an analysis of the root (Vol. III, p. 609, Wheeler's Reports), and finds the pith produced on agitating the pounded root in water is due to *saponin*. Of course, its marked detergent properties depend on this. The leaves of this also furnish a coarse fibre.

CHAPTER IV.

CATALOGUE

OF

PLANTS COLLECTED

IN

NEVADA, UTAH, COLORADO, NEW MEXICO, AND ARIZONA,

WITH

DESCRIPTIONS OF THOSE NOT CONTAINED IN GRAY'S MANUAL OF THE NORTHERN U. S., AND VOL. V, GEOLOGICAL EXPLORATION OF THE FORTIETH PARALLEL.

BY

J. T. ROTHROCK,

SURGEON AND BOTANIST TO THE EXPEDITIONS OF 1873, 1874, AND 1875,

AND THE FOLLOWING BOTANISTS:

SERENO WATSON, Cambridge, Mass.
GEORGE ENGELMANN, M. D., St. Louis, Mo.
Prof. THOS C. PORTER, Easton, Penn.
M. S. BEBB, Fountaindale, Ill.
WM. BOOTT, Boston, Mass.
GEORGE VASEY, M. D., Agricultural Department, Washington, D. C.
Prof. D. C. EATON, Yale College, New Haven, Conn.
THOS. P. JAMES, Cambridge, Mass.
Prof. EDWARD TUCKERMAN, Amherst, Mass.

CHAPTER IV.

CATALOGUE.

EXOGENS.

RANUNCULACEÆ.*

CLEMATIS DOUGLASII, Hook.—Clear Creek, Colorado. (92.)

CLEMATIS LIGUSTICIFOLIA, Nutt.—Nevada, Utah, Arizona, and (80) from Colorado. The number 498 from Camp Bowie, Ariz., is var. *Californica*, Watson (Fl. Cal. I, p. 3), characterized by leaves being "silky-tomentose beneath and often small".

CLEMATIS DRUMMONDII, T. & G.—Diœcious, "silky villous beneath, sparingly hirsute on the upper surface" (in my specimens from Cienega, Ariz., No 567, both surfaces are smoothish), leaflets ovate, deeply and acutely 3-lobed, sepals 4, lanceolate-oblong, carpels quite villous, with long and plumose styles, stem slender, grooved, and altogether much more graceful than *C. ligusticifolia.*

CLEMATIS ALPINA, Mill., var. OCHOTENSIS, Gray.—Subalpine ridges among timber, at 10,500 to 11,500 feet altitude. (91.)

THALICTRUM ALPINUM, L.—South Park, Colorado. At 10,000 feet. Typical specimens large. (94.)

THALICTRUM FENDLERI, Engelm.—Nevada, Arizona, Utah, Colorado in South Park at 10,000 feet altitude. (144 and 280.)

ANEMONE MULTIFIDA, DC.—South Park, Colorado, at 9,000 to 11,000 feet altitude. (105 and 108.)

ANEMONE PATENS, L., var. NUTTALLIANA, Gray.—Mountains of Colorado, at 6,000 to 10,500 feet altitude. (107.)

ANEMONE NARCISSIFLORA, L.—Six inches to a foot high, from a fibrous

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*Signs used: The degree (°) indicates feet. The minute (′) indicates inches. The second (″) indicates lines, *i. e.* $\frac{1}{12}$ of an inch. The hyphen means, *to*, *i. e.* 6–12′ is 6 to 12 inches. The figures in parentheses are numbers under which the specimens were distributed.

tufted root; petioles 1–4 inches long, leaves 3–5 parted, each segment lanceolate-cuneate and trifid; involucre sessile, its leaflets 3–5 cleft; carpels tailless, compressed, oval, and glabrous. Entire plant more or less densely covered with gray hairs; flowers white. Found in America most commonly from Canada north, but growing in Colorado on alpine summits, where, according to Mr. J. M. Coulter, it has been found at an elevation of 13,500 feet. (102 *a*.)

ANEMONE CYLINDRICA, Gray.—Willow Springs, Ariz.; rare there and probably by some accident introduced. (247.)

MYOSURUS MINIMUS, L.—Colorado; altitude, 8,000 feet and upwards; specimens much dwarfed. (169.)

RANUNCULUS AQUATILIS, L., var. STAGNATILIS, DC.—Denver. Flowers almost as large as *R. Purshii*, Richardson, var. *trichophyllus*, Chaix. Twin Lakes, Colo., at 9,500 feet altitude. (113 and 115.)

RANUNCULUS FLAMMULA, L., var. REPTANS, Gray.—Colorado. (172 and 173.)

RANUNCULUS HYDROCHAROIDES, Gray. (Pl. Thurb. p. 306.)—Glabrous throughout, flowering branches erect, numerous stolons branching off in all directions and rooting; lower leaves heart-shaped, and entire, or nearly so; petioles 2–3′ long, expanding and sheathing at the base; upper leaves lanceolate; peduncles about as long as the upper leaves, from opposite the axils of which they arise; sepals round, petals 3″, tapering into a claw, which has a conspicuous gland below a small sinus; stamens about 25; carpels 15–20, forming a head 2–3″ in diameter. Willow Springs, Ariz., growing in water at a temperature of 50° Fahr. at an elevation of 7,202 feet. A most interesting species, which I *believe* has not hitherto been taken so far north. (217.)

RANUNCULUS CYMBALARIA, Pursh.—In Colorado grows everywhere in low moist ground, evincing, however, a marked choice for alkaline soils, but still flourishing in the freshest of snow water; altitude, 5,000 to 10,000 feet.

From Saguache, in the San Luis Valley, we have a form with an erect, stout scape, bearing three or four flowers, having thicker and larger leaves, and manifesting little or no tendency to produce stolons.

At Santa Fé, N. Mex., I collected it (10) at what I presume is the

identical location from which Fendler obtained his plant, published by Dr. Gray in Pl. Fendl. p. 4, as *R. tridentatus*, H. B. K., and this I take to be the same form as that above alluded to from San Luis Valley. In addition to the difference noted by Dr. Gray in Pl. Fendl., I find the beaks of the achenia are in my specimens more tapering than in typical *R. Cymbalaria*. Collected also in California, Eastern Arizona, and Utah. (Colorado. 101.)

Ranunculus Andersoni, Gray.—Belmont, Nev. (Plate i, vol. v, King's Report.)

Ranunculus adoneus, Gray. (Enumeration of Plants, Parry, Hall, and Harbour.)—"Low, sparsely villous, becoming with age glabrous; root fasciculately fibrous; branching from base, with one to three leaves above, either erect, simple, and one-flowered, or fleshy, decumbent, and with two or more flowers; leaves twice pedately parted, segments narrowly linear, petioles at base with dilated scarious margins; peduncle short; corolla golden-yellow; conspicuous petals flabelliform, twice as long as the hairy, oval sepals; scale at base adnate, small."* Usually a strictly alpine plant. My specimens, however, were obtained as low as 6,000 feet above the sea-level.

Ranunculus glaberrimus, Hook. (Flor. Bor.-Am. tab. v.)—Leaves rather lanceolate than ovate.

Ranunculus affinis, R. Br., var. cardiophyllus, Gray. *R. cardiophyllus*, Hook. (Fl. Bor.-Am. tab. v.)—Colorado, at an elevation of 8,000 to 9,000 feet. (121 and 170.) Willow Springs, Ariz., at 7,202 feet altitude. Also collected by Dr. Loew in Western New Mexico.

Ranunculus sceleratus, L.—Cauline leaves, with a manifest tendency to division of the lobes; otherwise like an Eastern form. Colorado. (99, 110, 111, 116.)

Ranunculus Purshii, Richardson.—Among my specimens are a large number with petals trifid and the scales distinctly three-lobed. Twin Lakes, Colo, at an elevation of 9,500 feet. (117.)

Ranunculus hyperboreus, Rottb., var. natans, C. A. Meyer.—Stem weak, diffusely branched, glabrous, rooting from the nodes, creeping; leaves petioled, palmately 3–5-cleft, 3–5″ wide, lobes ovate, obtuse, petioles 6–12″; peduncles naked, 6–12″, often reflexed; sepals yellow, ovate, or

* When, as frequently occurs, I have been obliged to quote a specific description, it is from some imperfection in my own specimens.

oblong, 1–2″; carpels forming a compact, globose head, style very short or wanting. Twin Lakes, Colo.; altitude, 9,500 feet. (100.)

RANUNCULUS MACRANTHUS, Scheele.—Usually regarded as a mere variety of *R. repens*, L.; but I am satisfied from Mr. Watson's showing that it is distinct, as the greater villosity, the fewer stolons, the distinctly petiolulate leaflets, the more strictly reflexed sepals, the large flowers, and the long beaks to the carpels all indicate. Willow Springs, Ariz.; altitude, 7,202 feet.

RANUNCULUS RECURVATUS, Poir.—Style not conspicuously recurved, but in degree of hairiness, compressed achenia, relative size of sepals and petals, shape and dentition of scale, markedly corresponding with description given by T. & G. Colorado. (162.)

CALTHA LEPTOSEPALA, DC.—A common and characteristic plant in our Colorado collection; 8,000 to 12,000 feet above the sea. (109.)

TROLLIUS LAXUS, Salisb., var. ALBIFLORUS, Gray.—One of the most conspicuous early bloomers in alpine swamps, where, when found, it is quite abundant. Associated with the preceding plant. (102.)

AQUILEGIA CANADENSIS, L.—Arizona, lava rocks south of Camp Apache. Leaves smaller than our Eastern form. (268.) Western New Mexico, at high altitude, depauperate specimens. Coll. Loew. (164 and 167.) Utah.

AQUILEGIA FORMOSA, Fisch.—"Distinguishable from the last by its elongated sepals nearly or quite equalling the spurs, and by its stouter habit, growing only on stream banks in the mountains and flowering from July to September. Nevada and Utah; ranging from the Rocky Mountains to Oregon and Sitka, but not found in California."—WATSON.

AQUILEGIA CÆRULEA, James.—Introduced largely into cultivation, and to my mind the finest plant of the Rocky Mountains. Western New Mexico; altitude, 6,500 feet. Loew. Colorado; open woods; common; altitude, 10,000 feet. (163.) "Near Provo City, Utah. A reduced form of this species, with bright blue flowers, was collected at Kanab in Southern Utah, by Mrs. E. P. Thompson, in 1872. It has also recently been found in the Sierras near Mount Whitney" [Cal.].—WATSON.

AQUILEGIA CHRYSANTHA, Gray (Proc. Am. Acad. 8, p. 621). *A. leptocera*, Nutt., var. *flava*, Gray.—Usually, though not always, taller than

the preceding. Hard to distinguish from *A. cærulea* by any mere description, as they exhibit transitions at all points. The following appear to me to be the chief differences: flower, at least in Southern specimens, *always* golden yellow; sepals and petals nearly the same length, 1′; inflorescence paniculate, and continuing until terminated by cold weather. Common in damp ground and ravines of the mountain streams in the White Mountains and Mount Graham of Arizona. It is certainly no exaggeration to say that I have, near the Willow Springs, seen ten acres so completely covered with this plant in full bloom, that everything else was lost sight of. Arizona, at 7,000 to 10,200 feet altitude. (196.)

DELPHINIUM SCOPULORUM, Gray (Pl. Wright. 2, p. 9).—2½° high, puberulent throughout; lower leaves with petiole 4–6′, becoming shorter above; leaves round in outline, 3–5-parted, each division narrowly cuneate, again variously cut-lobed and toothed: raceme slender, one foot long; pedicels hairy, twice as long as the bract at base, one or two bractlets usually immediately below flower; spur over half an inch long, thickish, hairy, slightly curved, with markedly thickened extremity and one-half longer than the puberulent sepals; lower petals nearly as long as the sepals, slightly hairy within, upper one with a somewhat shorter blade, its spur nearly as long as that of the sepal; carpels 3, smoothish. Flowers are scattered loosely along the stem at intervals (when developed) of an inch. A species as variable as it is elegant. Tanks south of Camp Apache, Ariz. (263.) Altitude, 5,625 feet.

DELPHINIUM MENZIESII, DC.—Nevada; Snake River, Colorado. Dr. Vasey informs me that the plant (No. 96) which I published in the list of Colorado plants in 1874 as *D. elatum*, L., var., he has found, on comparison with the specimens in the Department of Agriculture Herbarium, to be *D. Menziesii.*

DELPHINIUM ELATUM, L., var ? OCCIDENTALIS, Watson.—Plant taller (5°) and more vigorous in every way than the others; leaves three-lobed, with each lateral lobe again divided, and all the lobes variously gashed and cut-toothed. The ample foliage, the long, hooked spur, acute sepals, the distinct spur on the lower petals, so far as they go, make the limits of this species in my collection tolerably well defined. Utah.

ACONITUM FISCHERI, Reich. (*A. nasutum*, Fisch., of my list of 1874.)—2–3°, smooth below, puberulent above; petioles of lower leaves 2–4′; leaves round in outline, 3–5-parted, with each division deeply lobed or cut-toothed; flowers in a loose raceme, pedicels ½–1′, pubescent, erect; petals, conical galea, and flowers from blue to purple or even white. Grows abundantly along mountain streams in Colorado. (98.) According to Mr. Watson, "A small specimen was collected in Southern Nevada with an unusually narrowed galea and long projecting beak." Also collected in Utah.

ACTÆA SPICATA, L., var. ARGUTA, Torr.—Flowers absent; pedicels vary from less than a quarter to more than half an inch in length in the fully formed fruit. There is no perceptible thickening of the pedicel with age, and this I take to be the most reliable characteristic furnished by the fruiting specimens.

PÆONIA BROWNII, Dougl.—Nevada.

BERBERIDEÆ.

BERBERIS FENDLERI, Gray (Pl. Fendler. p. 5).—Shrub 3–6°; branches and branchlets smooth and shining, as if varnished; spines 3–5-parted; leaves oblong-lanceolate, acutish, entire, or irregularly spinulose-serrate, entirely glabrous; racemes pendulous, 1–2′, and densely flowered, somewhat longer than the leaves, which, however, vary much in size in adult condition; calyx with conspicuous red bracts, which are a little shorter than the sepals. Flowers yellow and as large as those of *B. vulgaris*. Unripe fruit with 2–3 seeds; blooms in May and June. I probably collected my specimens from the exact spot at which Mr. Fendler obtained his. The shrub appears to be by no means common. Santa Fé, N. Mex. (54.)

BERBERIS REPENS, Lindl.—"A low, somewhat procumbent shrub, less than 1°; leaflets 3–7, ovate, acute, not acuminate, 1–2½′, not shiny above; racemes few, terminating the stems, 1–1½′.—*Bot Reg. t.* 1176. *B. Aquifolium*, Pursh, mainly, and of numerous authors."—(Fl. Cal. 1, p. 14.) I have not seen the species.

BERBERIS AQUIFOLIUM, Pursh.—Common in mountain parts of Central Colorado. (57.)

BERBERIS FREMONTII, Torr.—Leaves pinnate, with 3–4 pairs of leaflets,

the lowest pair of which is situated uniformly close to the insertion of the petiole; leaflets ovate, repand, spiny-dentate (In my specimens from Southern Utah, the leaflets are hardly half an inch long. Torrey, however, in Bot. Mex. Bound. p. 31, states that the leaflets are from 1–2¼'.) Racemes erect, 5–7-flowered, longer than the leaves; pedicels over half an inch long; flowers golden yellow, half an inch in diameter; filaments inappendiculate; berries large as currants. Its nearest affinity is with *B. trifoliata*, but it has more leaflets, longer racemes, and blue instead of red fruit. Arizona.

PAPAVERACEÆ.

ARGEMONE MEXICANA, L., var. HISPIDA, Torr. (*A. hispida*, Gray, Pl. Fendl. p. 5.)—Santa Fé, N. Mex., where it quite covers the vacant lots on the outskirts of the town. Collected also in Utah.

CORYDALIS AUREA, Willd., var. OCCIDENTALIS, Engelm.—Like our Eastern form of *C. aurea*, except that it has a longer spur, erect pods, and lenticular seeds with acute margins. Apparently this is the more common form from Colorado south along the main mountain axis. Sierra Blanca, Arizona, at 9,000 feet altitude (813); Nevada, Prof. Loew; Santa Fé, N. Mex. (55); and Colorado.

CRUCIFERÆ.

CHEIRANTHUS MENZIESII, Benth. & Hook.—Carlin, Nev.

NASTURTIUM SINUATUM, Nutt.—(618.) From San Luis Valley, on the alkaline flats; leaves absolutely coriaceous, though beautifully and regularly pinnatifid; (625) is from Apex, Colorado; like the other, though with much thinner leaves; (123) is from New Mexico, as is also (99), but which has quite acute tips to the lobes of the leaves: has also been collected by the Expedition in Nevada.

NASTURTIUM OBTUSUM, Nutt.—Twin Lakes, Colorado. (617.)

NASTURTIUM PALUSTRE, DC.—Twin Lakes, Colorado. (627.)

NASTURTIUM PALUSTRE, DC., var. HISPIDUM, Gray.—San Luis Valley, Colorado. (626.)

ARABIS PERFOLIATA, Lam. (*Turritis glabra*, L.)—In the enumeration of

1874, I had regarded this as an unusual form of *A. hirsuta.* Twin Lakes, Colorado (650)

ARABIS DRUMMONDII, Gray.—South Park, Colorado. (655.)

ARABIS HOLBŒLLII, Hornem.—Common and variable. Colorado and Nevada.

CARDAMINE CORDIFOLIA, Gray.—1–2°. Generally erect, from a fibrous root, which not unfrequently is in the water; leaves all petioled, cordate in outline, irregularly repand-dentate or sinuate, sparingly ciliate; siliques erect, twice as long as the pedicels. Common in Colorado at 10,000 feet altitude, in swamps and mountain streams. (608, 609, 610.)

VESICARIA LUDOVICIANA, DC.—Hoary throughout, with a stellate pubescence, erect, 6–10′ high, usually branching; root-leaves spatulate; stem-leaves linear to linear-lanceolate, all obtuse; flowers yellow; petals obovate, one-half longer than the sepals; pods oval, somewhat inflated, rather shorter than the style; pedicels 6–9″ long. Colorado. (641.)

VESICARIA MONTANA, Gray.—Colorado. (647.) By some oversight, I transposed the labels of these two species in distribution of the collection of 1873.

PHYSARIA DIDYMOCARPA, Gray.—Alpine and sub-alpine in Colorado. (642, 648.) The Expedition has it also from Nevada and Utah.

DRABA ALPINA, L.—A very attractive little perennial found in Colorado at 10,000 to 13,500 feet altitude; its favorite habitat being above timber line. (646.)

DRABA AUREA, Vahl.—Pubescent, erect; stem *usually* quite leafy; leaves lanceolate, acute, entire or sub-entire; siliques lanceolate, acute, nearly twice as long as the pedicels, hairy and more or less twisted; style $\frac{1}{2}$″ long; petals yellow. A very variable species, of extended range. The Expedition has it from Colorado, New Mexico (Loew 633 and 634); and from the higher mountains of Arizona, the var. *stylosa* of Gray (1111).

DRABA STREPTOCARPA, Gray.—Alpine in Colorado, along with *aurea.* My specimens furnish a singular example of transposition of characters usually reliable in distinguishing between these species; *i. e.*, *aurea* and *streptocarpa.* The specimens which have the fruit most characteristic of *streptocarpa* are in other respects most like (generally including length of

style also) *aurea*. I must, however, say that the fruit is in no instance so much twisted as in the original specimens on which *streptocarpa* was founded. That differences sufficient to constitute distinct species exist between the extreme forms, no one will probably deny. It is equally certain that they shade into each other until at times all tests are doubtful and justify a place under either name. In this instance, I have named as *streptocarpa* all specimens having leaves "beset and especially ciliate, with long and rigid, shaggy, spreading, simple or simply forked hairs, far more bristly than in *D. aurea*, and with no fine stellular pubescence intermixed." I rely more on this character in deciding between interloping specimens than on any other.

DRABA INCANA, L., var. CONFUSA, Hook.—I have from Colorado (number mislaid) a plant similar to herbarium specimens that are authentically named, and that bear the above name.

DRABA MONTANA, Watson.—"Annual, hoary-villous, with simple or branching rigid hairs, rather stout, erect, simple or sparingly branched from near the base, becoming a span high or less; leaves rosulate and rather crowded at and above the base of the stem, oblanceolate and oblong-lanceolate, acutish, sparingly toothed, half an inch long or less; flowers small, the yellow or yellowish petals 1–1½″ long, exceeding the sepals; pods linear-oblong, obtusish, roughly puberulent, about 4″ long, nearly erect upon the spreading pedicels, which are 2″ or 3″ long; style none.—Collected in Colorado by Hall and Harbour, without number; in South Park by Wolf (637), and near Empire by Rev. E. L. Greene. It is distinguished from *D. nemorosa* by its stouter and less branching habit and its more erect pods on stouter pedicels, and from *D. stenoloba* by its stouter habit, greater pubescence, and somewhat broader and obtuser pods."—WATSON, MS.

DRABA NEMOROSA, L., var. LUTEA, Gray.—Georgetown, Colo. Stems less leafy and pedicels shorter. (628.)

Numbers 635 and 636 of the Colorado collection I had named *D. nemorosa*, L., var. *crassifolia*, Watson, from the resemblance to *Draba crassifolia*, Graham, in Hall and Harbour's 1862 collection. Brewer and Watson (Fl. Cal. 1, p. 28) speak of this, however, as having a naked and scape-like stem, whereas my specimens are leafy. I therefore leave them simply under *D. nemorosa*, L.

SISYMBRIUM CANESCENS, Nutt.—Colorado and Nevada. From Ash Creek, Arizona, I have specimens (306) that are an enigma to me; the very sharp cut to the leaves, the great glandular-hairiness, the linear pods, and filiform pedicels almost tempt me to call it a new species It does not appear to be either *incisum* of Engelman or *auriculatum* or *diffusum* of Gray.

SISYMBRIUM INCISUM, Engelm. (Pl. Fend. p. 8). (*S. Californicum*, Watson, in King's Report)—Nevada and Utah.

SISYMBRIUM VIRGATUM, Nutt.—"6–12′ high; stems simple or branched from the base (or sometimes branched above), slender, covered below with an ashy, simple, or forked pubescence; leaves tomentose pubescent; those of the root petioled, lanceolate-oblong, and sinuate-dentate; stem leaves sessile, lanceolate, auriculate, and clasping at base, entire, denticulate, or slightly wavy-margined, 6–8″ long; flowers pale purple, 2″ in diameter; stigma almost sessile; pods 1–1½′ long, and 3–4 times exceeding the slender pedicels; seeds 4-angled, 'in a double series.'" (605, 606, 652.) South Park and Twin Lakes, Colorado.

SMELOWSKIA CALYCINA, Meyer.—Alpine regions of Colorado. (601.)

ERYSIMUM CHEIRANTHOIDES, L.—Twin Lakes, Colorado, 9,000 feet altitude. (651.)

ERYSIMUM ASPERUM, DC.—Nevada and Utah.

ERYSIMUM ASPERUM, DC., var. ARKANSANUM, Nutt.—Central Colorado. (593, 596, 599, 640.)

ERYSIMUM ASPERUM, DC., var. PUMILUM, Watson.—Blue River. (594.)

ERYSIMUM WHEELERI, *sp. nov.*—3–5° high, erect, unbranched, sparsely covered with closely appressed hairs, which are fixed by the middle (very rarely forked), never 4-parted; root-leaves, including petiole, into which they gradually taper, 2–4′ long, narrowly lance-linear, entire or sub-entire; stem-leaves narrowly lanceolate, sessile, 1–2½′ long, entire; pedicels (in fruit) ¼–½′ long; mature pods erect, 1–2′ long (in younger pods there are distinct ribs between the angles), canescent; stigma two-lobed, style evident; seeds attached to each side of cell; cotyledons obliquely incumbent; petals varying from yellow to scarlet, twice as long as sepals, claw ½′ long, nearly filiform, lamina obovate, little over ¼′ long.

This is a strikingly showy plant; stem rises gracefully to a height of 5 feet often, and is crowned with a cluster of scarlet mottled flowers.

The lax, scattering arrangement of the leaves is in striking contrast to the usually more crowded arrangement in *E. asperum*. Judging from the description in Flora of North Am. T. & G. p. 95, I should think its nearest affinity would be *E. elatum*, Nutt. MSS. Still it appears distinct from this, all the more probably so, as the only points at which it was taken were Camp Grant, Ariz., and Mount Graham, near by, but 5,000 feet higher, where it had developed some local peculiarities without bringing it any nearer known species. The stem of the mountain plant was more light, airy, leaves smaller and more numerous, and pods longer, but with essentially the habit of the same species at the foot of the mountain.

I am loth to name a new *Erysimum*, for reasons which are apparent to all who have studied the genus. Still, this seems too well marked a species to pass it by.

THELYPODIUM INTEGRIFOLIUM, Endl.—South Park, Colorado (645.) Nevada and Utah.

THELYPODIUM LINEARIFOLIUM, Gray.—Very smooth, 3°; leaves few, linear or linear-lanceolate, sessile, 2–3′ long, 2–3″ wide, slightly glaucous; petals purplish, with claws twice as long as the sepals; style very short; seeds immarginate, oblong. (154.) Pescao, N. Mex.

THELYPODIUM SAGITTATUM, Endl.—Carlin, Nev.

THELYPODIUM LONGIFOLIUM, Watson. (*Streptanthus micranthus*, Gray, Pl. Fendl. p. 6.)—Stem slender, 2°, roughish below, glabrous above; flowers 1–2″ long; leaves hirsute, somewhat toothed, or lower leaves distinctly dentate; pods erect or pendulous, terete. Sanoita Valley, Arizona. (610.) Altitude, 6,500 feet.

THELYPODIUM WRIGHTII, Gray (Pl. Fendl. p. 7).—Biennial?, 2–3° high; smoothish leaves, narrowly lanceolate; lower ones pinnatifid, deeply dentate or even sub-entire; upper ones sub-entire or entire. All tapering into petioles, upper ones 2″ wide, 1–2½′ long; pedicels in fruit ¼–¾′ long, spreading. Pods erect, or nearly so, 1½–2½′ long, filiform. Petals white, clawed, a little longer than the sepals. The aspect of the plant is peculiar from its densely spicate flowers, leaving a mass of long, thread-like pods at

the summit of the stem. There is great variation in the degree to which the leaves are cut or toothed and in the hairiness of the entire plant. Camp Grant, Ariz., at 4,753 feet altitude. (363.)

CAMELINA SATIVA, Crantz.—Introduced in Colorado.

"TROPIDOCARPUM * GRACILE, Hook.—Stems weak, 2 feet high or less; leaves pinnatifid or rarely 2-pinnatifid, with narrow, or linear segments; flowers in the axils of the upper bract-like leaves; petals 1½–3″ long, nearly twice longer than the obtuse sepals; pods 6–20″ long, more than a line broad, pointed at both ends, ascending or slender spreading pedicels 10–20″ long. San Francisco Mountains, Arizona." I have not a specimen accessible, and therefore have been obliged to quote generic and specific description from Fl. Cal. 1, p. 44.

CAULANTHUS CRASSICAULIS, Watson.—Frequently called Wild Cabbage, and used as a substitute for the better article. Nevada.

LEPIDIUM INTERMEDIUM, Gray.—The usual apetalous Western form. Boulder, Colo., Loew and Wolf. (597.)

LEPIDIUM ALYSSOIDES, Gray. (Pl. Fendl. p. 10.)—Keasby, collector. Peoria Creek, New Mexico.

LEPIDIUM MONTANUM, Nutt.—Old Camp Goodwin, Ariz. (341.) 3,000 feet altitude. San Luis Valley, Colorado. (624.)

LEPIDIUM FREMONTII, Watson?—Probably this species. Specimen too young. Collected by Dr. Loew in Nevada. (King's Report, vol. v, plate iv.)

LEPIDIUM NANUM, Watson. (King's Report, vol. v, plate iv.)—Halleck Station, Nev.

THLASPI ALPESTRE, L. (?)—I have no sufficient means of comparing this with the European plant, but accept Mr. Watson's determination. Exceedingly variable. Common in alpine and sub-alpine regions of Central Colorado. (607.)

BISCUTELLA† (DITHYRÆA) WISLIZENI, Engelm.—A foot or more high,

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* "TROPIDOCARPUM, Hook.—Pod linear, flattened laterally, often one celled by the disappearance of the narrow partition; valves carinate, 1-nerved. Seeds in two rows, minute, flattened, not winged; cotyledons incumbent. Style short.—A low, slender, hirsute, branching annual, with pinnately divided leaves, and yellow solitary axillary flowers."

† BISCUTELLA, L.—Sepals nearly equal. Silique dehiscent, very flat, divided into lateral ovate halves, each of which is surrounded by a cord-like margin. Each cell contains a single immarginate seed. Herbs, usually erect, branching and hispid; leaves more or less pinnatifid; flowers bractless, yellow.

covered throughout with a fine, but dense, stellate pubescence; leaves linear-lanceolate to broadly lanceolate, entire, slightly undulate or deeply pinnatifid; pedicels 3–8″ long and in fruit most frequently spreading or deflexed; each half of the pod roundish, from 1–3″ in diameter; style $\frac{1}{2}$″ long; sepals hairy outside, nearly as long as the petals. New Mexico, from Zuñi River, near, I think, the location of the first discovery of the plant. Also obtained in Arizona.

CAPPARIDEÆ.

CLEOME AUREA, Nutt.—Boulder, Colo., 1873. Loew.

CLEOME LUTEA, Hook.—Much like *C. aurea*, except that the stamens are unequal and unlike; of the six, two are longer, with small, curved anthers, and four are shorter, with mucronate anthers. The figure (tab. xxv in Hook. Fl. Br. Am.) shows by mistake two short and four long anthers. Nevada.

CLEOME SONORÆ, Gray.—Annual, glabrous, erect; leaves trifoliate, with short petioles; leaflets entire, linear; pod turgid, somewhat longer than the stipe, which is about $\frac{1}{3}$–$\frac{1}{2}$ as long as the pedicel; flowers purplish. Anthers 6, linear. San Luis Valley, Colorado. (761.)

CLEOME INTEGRIFOLIA, T. & G.—Utah.

CLEOMELLA PARVIFLORA, Gray.—Nevada.

CLEOMELLA LONGIPES, Torr.—Loew. (180.) No locality assigned; probably from Arizona.

CLEOMELLA OBTUSIFOLIA, Torr. & Frem.—"Branching from the base and diffuse; leaflets cuneate-obovate, obtuse; style filiform. Annual, stem smooth, the branches spreading, about a span long, hairy in the axils. Leaves or petioles an inch or more in length; the lamina of the leaflets 4–6″ long, apiculate with a deciduous bristle, nearly smooth above, strigose underneath. Pedicels solitary and axillary, in the upper part of the branches, longer than the petioles. Calyx much shorter than the corolla, the sepals lacerately 3–5-toothed. Petals yellow, oblong lanceolate, obtuse, about 3″ in length. Stamens 6, unequal, a little exserted; anthers linear-oblong, recurved when old. Torus hemispherical. Ovary on a long slender

stipe, obovate; style longer than the ovary."—(Torr. Fremont's Report, p. 311.) Nevada.

Polanisia uniglandulosa, DC.—Loew. New Mexico.

Polanisia graveolens, Raf—Upper Arkansas Valley, Colorado (760); also New Mexico.

VIOLACEÆ.

Viola Canadensis, L.—Western New Mexico, Valle Grande, Loew, 1873, and Apex, Colorado. (77 and 78.)

Viola canina, L.—Colorado and Nevada. (75.)

Viola cucullata, Ait.—Western New Mexico, at 6,500 feet altitude.

Viola Nuttallii, Pursh.—Colorado, near Denver. (76.) Nevada.

BIXINEÆ.

Amoreuxia* Scheideana, Planch. (Pl. Wright. 1, tab. 3, and 2, tab. 12).—*Glabrous or nearly so*, 1° high, leaves on long petioles, orbicular in outline, 7–9-parted, with the lobes obovate, cuneate at base and sharply serrate toward the top; capsule 1′ long and nearly as broad, moderately inflated; seeds curved and minutely roughened with short, scattering hairs; flowers deep orange, with brownish markings in the centre. Sanoita Valley, Arizona. Altitude, 5,500 feet. (647 and 640)

POLYGALEÆ.

Polygala alba, Nutt.—Perennial, with several slender virgate stems ascending from the same root, smoothish, 1° high; leaves linear to oblanceolate, sessile or barely petioled, margins slightly revolute; stem leafy half way to the summit; flowers deciduous, leaving the rachis roughened after their fall, white; wings of the calyx rounded, about as long as the corolla; seed with caruncle extended into two ear-like lobes nearly as long as the seed. Willow Spring, Ariz. Altitude, 7,195 feet. (207.)

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* Amoreuxia, Moc. et Sess. in DC. Prod. ii, p. 638.—Flowers hermaphrodite. Sepals 5, imbricated, deciduous. Petals 5, large, contorted-imbricated. Stamens many, inserted upon the glandless receptacle; anthers linear, bivalved, with short confluent lines of dehiscence under the apex. Ovary perfectly 3-celled; placentas united in the centre, ovules many; style simple, stigma minutely denticulate; endocarp membranous, separating into 3 valves alternating with those of the epicarp. Seeds obovoid, straight or incurved, smooth, testa bony, surrounded by a loose exterior membrane; cotyledons broad, curved, or with an incurved hook.—Bentham & Hooker.

POLYGALA PUBERULA, Gray (Pl. Wright. 1, p. 40).—Perennial, with several erect or sub-erect stems from the same root, covered with a very soft, short, ash-colored pubescence: leaves with very short petioles, ovate, lance-ovate, or lanceolate, obtuse, but slightly mucronate, leafy to the raceme, which is lax and somewhat elongated; flowers and fruit pendulous; keel naked; wings ovate or obovate, and very slightly ciliolate; pods oval, ciliate, and covered with a very soft down when young; when older, hairiness is limited to the thickened margin. Floral envelopes are deciduous, leaving the pod naked. An interesting, though variable species. (312.) Ash Creek, Arizona. (504 and 459.) Camp Bowie, Ariz.

MONNINA * WRIGHTII, Gray (Pl. Wright 2, p. 31).—Annual, erect, smooth; leaves narrowly lanceolate, acutish, entire, with a petiole ½″ long; raceme terminal, or secondary racemes coming out of the axils; fruit and flowers on pedicels ½–1″ long, deflexed; flowers 1–2″ long, greenish, with distinct purple blotching; fruit 2″ in diameter, winged, on one side much larger than on the other. (622.) Sanoita Valley, Arizona.

KRAMERIA PARVIFOLIA, Benth.—Cienega, Ariz. (572.) Nevada.

FRANKENIACEÆ.

FRANKENIA† GRANDIFOLIA, Cham. et Schlecht.—Stem usually prostrate, 6–12′ long, woody or hard at base; leaves 6″ long, cuneiform, mucronate; margins slightly revolute, thickish, under the lens hairy and ciliate at the base, connected at their insertion by a hairy, stipular membrane. Southern

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* MONNINA, Ruiz. et Pav.—Sepals unequal, 2 interior large, petaloid and wing-like. Petals 3; keel concave-galeate, entire or broadly 3-lobed (from the two exterior petals being united with the keel?), free; 2 interior shorter, sub-connivent, variously shaped, inserted upon the stamineal tube. Stamens 8, united in a sheath; anthers 1–2-celled, opening introrsely by an oblique apicular foramen. Ovary 1–2-celled; style incurved; stigma two-lobed at the apex. Fruit indehiscent, 1–2-seeded, either drupaceous, or dry and wingless, or margined with a membranous wing. Seeds estrophiolate, glabrous; albumen almost none; cotyledons thickish. Herbs, shrubs, or small trees. Leaves alternate or scattered. Raceme spike-like, terminal, lateral, or occasionally axillary.—BENTH. & HOOK.

† FRANKENIA. Linn.—Calyx tubular or prismatic, furrowed; the 4 or 5 lobes valvate and induplicate in the bud. Petals 4 or 5, hypogynous; the blade tapering into a claw, which bears an appendage (crown) on its inner face. Stamens 4–7 or rarely more, hypogynous. Ovary 1-celled, with 2–4, few- to several-ovuled parietal placentæ; style 2–4-cleft into filiform divisions; stigmas unilateral. Capsule included in the persistent calyx, 2–4-valved; the few or several seeds attached by filiform stalks to margin of the valves. Leaves small, mostly crowded and also fascicled in the axils, sessile or nearly so, the pair often united by a membranous, somewhat sheathing base; flowers small, perfect, solitary and sessile in the forks of the stem, or by the reduction of the upper leaves to bracts becoming cymose-clustered on the branches; corolla pink or purplish.—Fl. Cal. i, p. 60.

Nevada, of which form Mr. Watson remarks, "Nearly glabrous, with some stiff hairs upon the stipules and traces of pubescence upon the stem and capsules. The leaves are intermediate between the ordinary form of California, with mostly obovate leaves, and those of the recently described species (*F. Jamesii*, Torr.; Gray in Proc. Amer. Acad. 8, 622). Colorado and Texas."

CARYOPHYLLEÆ.

SAPONARIA VACCARIA, Host.—Introduced about the Mormon settlements in Utah.

SILENE ACAULIS, L.—Utah, Colorado, among the mountains at 11,500 feet altitude and upward. (362.)

SILENE MENZIESII, Hook.—Twin Lakes, Colorado. (355.)

SILENE GREGGII, Gray (Pl. Wright. 2, p. 17). (*Melandrium Greggii*, Rohr.)—More or less viscidly pubescent; two or three erect stems from the same perennial root; lower leaves lance-ovate or obovate, shorter than the upper, which are lanceolate to ovate, sessile or tapering into very short petioles, $1\frac{1}{2}$–2′ long; calyx-lobes obtuse, or acute, sometimes with scarious margins; lamina of petals crimson, divided into 4 lobes, of which the lateral are the shorter, corona 2-parted, truncate, with the lobes slightly erose-dentate. Stamens exserted. Mount Graham, 7,000 to 9,500 feet altitude. (420, 734.) Also collected by Dr. Loew on the mountains of Arizona. This species Mr. Watson considers a variety of *S. laciniata*, probably correctly.

SILENE SCOULERI, Hook.—Stem erect, smooth below and slightly glandular-pubescent above; leaves narrowly lanceolate, tapering very gradually to the base, lowest 6′ long, upper ones shorter; racemes sub-compound, *i. e.*, two or three flowers coming off at the same point of the stem. Calyx about as long as the pedicel, lobes acute, with scarious, ciliate margins; petals white or flesh-colored, claws with acute auricles, filaments woolly, ciliate; capsule three times longer than the stipe. Mount Graham, Arizona, at 9,000 feet altitude. (739.)

LYCHNIS APETALA, L.—Colorado.

LYCHNIS DRUMMONDII, Watson.—South Park, Colorado. (363.)

CERASTIUM VULGATUM, L.—Colorado. (352.)

CERASTIUM NUTANS, Raf.—Sierra Blanca, Arizona, at 9,000 feet altitude (803), and Mount Graham (403).

CERASTIUM ARVENSE, L.—South Park and Blue River, Colorado. (348, 350, 351, 353.)

STELLARIA JAMESII, Torr.—Colorado (339), Nevada, and Utah.

STELLARIA LONGIPES, Goldie —Colorado. (338, 340.) The plant (340) from Colorado, which I published and distributed as *S. longifolia*, is without doubt *S. longipes*.

STELLARIA CRASSIFOLIA, Ehrhart.—Nevada.

ARENARIA SAXOSA, Gray (Pl. Wright. 2, p. 18).—Perennial, 5–12′ high, slightly hispid-pubescent; leaves sessile (lower ones sub-connate at base), lanceolate acute, 6″ long, 1–2″ wide; raceme many-flowered, somewhat cymose, pedicels ½–¾′ long; sepals very acute, somewhat scarious-margined, with a distinct, almost keel-like midrib, which is decidedly hispid; the obovate white petals as long as, or a little longer than, the sepals. (412.) Mount Graham, Arizona, at 9,000 feet altitude.

My specimens appear decidedly more luxuriant than those on which the species was founded. The distinctive features are so well marked, however, that I can hardly consider it as anything else.

ARENARIA CAPILLARIS, Poir—Utah.

ARENARIA FENDLERI, Gray (Pl. Fendl. p. 13).—South Park, Colorado (349), and near Cosino Caves, Arizona, in *pine woods*. Loew, collector.

ARENARIA FENDLERI, Gray, var. SUBCONGESTA, Watson.—Twin Lakes, Colorado, 11,000 feet altitude (868); Utah.

ARENARIA VERNA, L.—Mosquito Pass, Colorado. (345.)

Var. HIRTA, Fenzl.—More densely cæspitose than the typical *A. verna;* leaves broader, rougher, and obtuse; flowering stems shorter. South Park, Colorado. (346.)

ARENARIA (ALSINE) BIFLORA, Wahl.—Under this I include all the numbers 364, 343, 344, representing respectively the names *A. arctica*, Stev., var. *obtusa*, *A alpina*, L., *A Rossii*, R. Br., of the catalogues of the Colorado collection It was by a clear inadvertency that the name *A alpina*, L., was used at all, as it does not, so far as I can find, appear any-

where as a species of Linnæus's. I also include the same name in Porter's and Coulter's *Flora of Colorado.*

Cæspitose, more or less woody at the base, forming either a compact mass, or sometimes with the stems more lax and lengthened; leaves sometimes obscurely three-nerved, narrowly linear, more or less roughened; peduncles pubescent; petals longer than the obtuse sepals.

ARENARIA LATERIFLORA, L.—Twin Lakes, Colorado. (347.)

SAGINA LINNÆI, Presl.—Colorado. (341, 342.)

DRYMARIA* EFFUSA, Gray (Pl. Wright. 2, p. 19).—Annual, smooth; root-leaves ovate, short-petioled, 2″ in diameter; lower internode 2′ long; stem-leaves linear-setaceous, 4–8″ long; dichotomously branched above; pedicels very slightly glandular pubescent, twice as long as the flower; sepals obtuse, with scarious margins; petals quite narrow, deeply two-lobed, and a little longer than the sepals. The whole plant is hardly three inches high. (619.) Sanoita Valley, Arizona, at 6,500 feet altitude. Found, *so far as I have seen*, only among the oak trees and on a gravelly soil.

PORTULACACEÆ.

PORTULACA OLERACEA, L. ? ?—The specimens from Colorado (989) are all too old to determine with certainty.

PORTULACA LANCEOLATA, Engelm.?—Arizona. Poor specimens. Chiricahua, Southern Arizona, growing on dry sandstone rocks. (521.)

TALINUM AURANTIACUM, Engelm.—Herbaceous, with a woody base, 1–2° high, erect or sometimes branching from the base, glabrous or with a few spreading hairs; leaves lanceolate, thickish, sessile, 1–2′ long; peduncles with two small bracts, 4–5″ long, articulated above the base; flowers orange-colored, single in the axils, somewhat reflexed in fruit; sepals 4–5″ long; petals somewhat longer; mature seeds black, elegantly marked with strong circular lines, and with others less strong, but transverse to them. (346.) Cottonwood, Ariz., in rocky places.

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*DRYMARIA, Willd.—Sepals 5, herbaceous or with scarious margins. Petals 5, 2–6-cleft. Stamens 5, or fewer by abortion, somewhat perigynous. Ovary 1-celled, with many ovules; style 3-cleft. Capsule 3-valved. Seeds roundish kidney-shaped, or laterally compressed, hilum lateral; embryo peripheral. Diffuse or rarely erect herbs, branching dichotomously. Leaves flat, broad or narrow. Stipules small, often fugacious. Flowers pedicellate, solitary in the forks, or often in terminal cymes or axillary and scattering.—BENTHAM & HOOKER.

TALINUM AURANTIACUM, Engelm., var. ANGUSTISSIMUM, Gray.—Similar to the above, except that the leaves are linear, the articulation of the peduncle often nearer the axil, sepals approaching the orange color of the corolla, and the plant usually lower, averaging 8′ in height. (538.) Rocky ledges at Chiricahua Agency, Arizona.

TALINUM PATENS, Willd.?—1–2° high, glaucous; leaves broadly lanceolate, thin, entire; flowers purple, in bud twice longer than the obtuse sepals; inflorescence loose, panicled along the slender branches; seeds not mature enough to certainly identify the specimen. (522.) Chiricahua Agency, Arizona, on rocky ledges, along with *T. aurantiacum* var. *angustissimum.*

CALANDRINIA* PYGMÆA, Gray (Proc. Am. Acad. viii, p. 623). (*Talinum pygmœum*, Gray.)—Colorado. (73.)

CLAYTONIA ARTICA, Adams, var. MEGARHIZA, Gray.—High mountains of Colorado; strictly alpine. The large root penetrates a foot or more among the rocks. (74.)

CLAYTONIA CHAMISSONIS, Esch. & Ledeb.—Seeds evenly and beautifully roughened with minute scale-like markings. I find no allusion under description of this species to the markings of the seed, nor have I any ripe seed in other authentically determined specimens of the species, but in all the other characteristics my plant is so like the broader-leaved form, No. 84, of Hall and Harbour, that I cannot doubt the specific identity of the two. (219.) Willow Spring, Ariz.; altitude, 7,195 feet. Found growing luxuriantly in spring water the temperature of which was 52° Fahrenheit.

CLAYTONIA CAROLINIANA, Michx., var SESSILIFOLIA, Torr. (*C. lanceolata*, Pursh.)—Nevada.

LEWISIA REDIVIVA, Pursh.—Nevada.

ELATINEÆ.

ELATINE AMERICANA, Arn.—Twin Lakes, San Luis Valley, and Rio Grande at Loma, Colo. (775, 776.)

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* CALANDRINIA, H. B. K.—Differs from *Talinum*, Adans., chiefly in having persistent sepals and estrophiolate seeds.

TAMARISCINEÆ.

FOUQUIERA * SPLENDENS, Engelm.—Shrub 5–15° high, spiny, with clusters of leaflets in the axils of the spines (the larger primary leaves being seldom seen); flowers in a strict or a thyrsoid panicle, bright scarlet, 1′ long. A most remarkable looking plant (standing usually out on an open sun-exposed slope), with its strict, striated, almost leafless stem crowned by a mass of beautiful scarlet flowers.

HYPERICINEÆ.

HYPERICUM SCOULERI, Hook.—Utah, Arizona. (210, 384.)

MALVACEÆ.

SIDALCEA CANDIDA, Gray.—Collected by Mr. Hance, but neither number nor locality given. Probably from New Mexico or Arizona.

SIDALCEA MALVÆFLORA, Gray.—A somewhat variable and widely diffused species. The Expedition has it from Colorado to Southern Arizona and New Mexico and west to Southern California. (14.)

MALVASTRUM COCCINEUM, Gray.—Colorado, Arizona, New Mexico, Utah. The var. *dissectum*, Gray, we have also from Utah and New Mexico. So far as my specimens go, the variety seems to evince a marked liking for the more dry and sandy regions

MALVASTRUM MUNROANUM, Gray.—Not unlikely that this and *Sphæralcea Emoryi*, Torr., are the same, as according to Mr. Watson's showing the two correspond in all respects, save that the latter usually has two seeds to the carpel. It sometimes has but one, and then the distinction vanishes. Mineral Hill, Nev.

ANODA† HASTATA, Cav., var. DEPAUPERATA, Gray (Pl. Wright. 2, p. 23).—

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* FOUQUIERA, H. B. K.—Sepals 5, free. Petals united into a tube; the lobes of the limb imbricated, spreading. Stamens 10–15, hypogynous, exserted; filaments thickened at base. Ovary imperfectly 3-celled; placentæ about 6-ovuled; styles 3, long, somewhat united. Seeds 3 to 6, oblong, flattened, surrounded by a dense fringe of long white hairs or by a membranous wing.—Shrubs or small trees, with soft fragile wood, smooth; the branches alternately spinose-tubercled, and with single or fascicled thick entire leaves in the axils; flowers brilliant crimson, in terminal spikes or panicles.—Flora Cal. 1, p. 79.

† ANODA, Cav.—Bracteoles none. Calyx 5-cleft. Stamineal column divided at the apex into many filaments. Cells of the ovary many, 1-ovuled, branches of style as many as the cells of the ovary, filiform, capitate, or truncate-stigmatose at the apex. Mature carpels forming a broad starlike verticil [from the outwardly projecting spurs]; separating from the axis, erostrate, dissepiments obliterated.—Seed pendulous, or fixed horizontally: Hispid or smoothish herbs with the habit of Malva. Leaves entire, hastately 3-lobed, or rarely dissected. Flowers violet or yellow, pedunculate, axillary, or in a terminal raceme.—BENTHAM & HOOKER.

Annual, stem erect, smoothish, or with a few scattering hairs; lower leaves small, roundish, crenate; stem-leaves long, petioled, thin, irregularly deeply cleft or strongly halbert-shaped; flowers axillary, sky-blue, ½–¾′ in diameter (apparently resembling *A. parviflora*, Cav.). Calyx-lobes twice as long as the tube and distinctly bristly hirsute. Much against my will, I am obliged to retain this still as a variety, there being, so far as I can discover, little deviation from the typical form save in the size of the flowers. Camp Crittenden, Southern Arizona, at 5,200 feet altitude. (666.)

Var. PARVIFLORA, Gray.—A low annual, 3–6′ high, with a few ovate, crenate leaves on long petioles, was collected by Dr. Loew at some locality in Arizona. (165 *a*.)

SIDA HEDEREACEA, Torr. (in Pl. Fendl. p. 23).—Loew. New Mexico, Utah.

SIDA LEPIDOTA, Gray (Pl. Wright. 1, p. 18).—A much-branching, prostrate species, from a descending root; leaves petioled, triangular-cordate or somewhat hastate (quite variable), at first densely covered with a stellate pubescence *below* and scurfy *above;* peduncles axillary, bearing a single purple flower 8″ in diameter. Carpels with a short, obtuse beak. Deer Spring, Ariz., 6,000 feet altitude. (188.)

SIDA FILIFORMIS, Moric. var.—Stems thin, wire-like, procumbent or ascending, with long white hairs scattered along the stem and on the calyx; petioles 3″–1′ long; leaves 6–12″ long, lanceolate to oval, usually crenately serrate and more or less densely covered on either side with a short, stellate pubescence; calyx angular, lobes acuminate, nearly as long as the yellow petals; carpels moderately beaked. (665.) Sanoita Valley, Arizona. From Camp Bowie, I have a form which is much *more hairy, has leaves larger in all respects, and almost beakless carpels.* (470.) I have a full *suite* of specimens, and am unable to connect these forms. Hence, I believe they will, as we know them better, be regarded as distinct.

SPHÆRALCEA ACERIFOLIA, Nutt.—"Minutely roughish-tomentose, with a stellate pubescence; leaves 5-lobed, somewhat cordate; the lobes acute, toothed, unequally serrate; peduncles aggregated, terminal; carpels 12–14, pointless.—Stem much branched. Leaves 2–2½′ long, and about the same in width: petioles about ⅓ of the length of the lamina. Flowers 3–4 together at the summit of the branches. Bracteoles linear-lanceolate.

Calyx cleft to the middle, segments broadly ovate, acute. Corolla an inch in diameter; purple (in dried specimens). Carpels pilose, dehiscing on the back from the summit to the base."—(T. & G.) Utah.

SPHÆRALCEA FENDLERI, Gray.—San Francisco Mountains, Arizona and Utah. Taller, more branching, with larger leaves, and beaked carpels. New Mexico.—Forming a transition in some of its forms into the next. *S. incana* var. *dissecta*, Gray, now comes here.

SPHÆRALCEA ANGUSTIFOLIA, Spach, "var. *foliis lanceolatis, inferioribus nunc hastato-sub-trilobatis*," Gray.—Sanoita Valley, Arizona. (634.) The plant is erect, somewhat branching at the top; flowers arranged in contracted racemose panicles on the ends of the branches; leaves with the characteristic, eroded margins. A showy plant. My specimens were found growing in dry lava soil. (Those of Wright came from alluvial soil.)

SPHÆRALCEA EMORYI, Torr. (Pl. Wright. 1, p. 21).—Nevada and New Mexico. In Benth. and Hook. Genera Plantarum, we find *Malvastrum* and *Sphæralcea* in different sub tribes and separated by eleven interpolated genera, yet considering the habit of *Sphæralcea incana*, var. *dissecta*, and the resemblance between *S. Emoryi* and *Malvastrum Munroanum*, coupled with the broader generalization of Bentham and Hooker under head of *Sphæralcea*, as to the resemblance in habit, it may well be doubted as to whether the genera should not (in part at least) be thrown together. Colorado, New Mexico.

HIBISCUS DENUDATUS, Benth. (Bot. Voy. Sulph. p. 7, tab. 3). (*β. involucellatus*, Gray, Pl. Wright. 1, p. 22.)—One or two feet high, with a few long, thin branches; leaves distant, 1–2′ long, $\frac{1}{2}$–$\frac{3}{4}$′ wide, obtuse, irregularly crenate serrate, petioles 3–6″ long; petals light purple, 8–10″ long; bracts of the involucel setaceous, 9″ long; entire plant, except the flower, densely covered with a stellate pubescence. (562.) Cienega, Ariz. (near Tucson).

THURBERIA* THESPESIOIDES, Gray (Pl. Nov. Thurb. p. 308).—Perennial,

*THURBERIA, Gray (Pl. Nov. Thurb. 308).—Bracteoles 3, cordate. Calyx truncate. Stamineal column produced above [almost to the apex] into many filaments. Ovary 3-celled with a few ovules [6–8] in each cell; style club-shaped at the apex. [Stigmatose on the three projecting angles.] Capsule loculicidal, 3-valved. Seeds obovoid, angular, minutely woolly, without albumen; embryo conduplicate, cotyledons foliaceous, covered with black spots, much folded, almost including the inferior radical.—Tall, smooth herbs. Leaves entire or 3-parted. Flowers white or rose colored, solitary on axillary or terminal peduncles.—GRAY in BENTHAM & HOOKER, Gen. Pl. 1, p. 209. For a much more full description, see Gray, Pl. Thurb. *l. c.*, and for a good figure of this, the only species of the genus, see Bot. Mex. Bound. pl. 6.

herbaceous, much branched, 5° high; stem smooth; stipules falling away very early; leaves deeply 3-parted, with the divisions lanceolate, tapering into a long point; bracts three times as long as the truncate cyathiform calyx; petals very delicate rose color, 1′ long, obovate, woolly at the base on margins; style longer than the stamineal column. Young branches, petioles, leaves, and flowers sprinkled abundantly with black dots. (698.) Sanoita Valley, Southern Arizona.*

STERCULIACEÆ.†

AYENIA‡ PUSILLA, L., var. *ramis erectis, foliis superioribus lanceolatis*, Gray (Pl. Wright. 1, p. 24).—Perennial, with many thin, wiry stems from the thick, woody root; lower leaves ovate and somewhat irregularly serrate, upper ones irregularly serrate, twice as long, and lanceolate; flowers small, on reflexed, filiform pedicels, which are 2–4″ long; capsule tuberculated and hairy. I would call attention to the fact observed by Dr. Gray (Pl. Wright. 2, p. 24), that the anthers are trilocular. Judging from the statement in Bentham and Hooker, Gen. Plant. vol. 1, p. 225, this would also appear to be the usual rule in the genus. My specimens (569) from Southern Arizona correspond exactly with those obtained by Dr. Thurber at Van Horn's Wells, in what was then Sonora.

LINEÆ.

LINUM RIGIDUM, Pursh, var. *puberulum*, Gray (Pl. Wright. 1, p. 25).—Low, 2′–4′ high, annual, branching from near the base; stems decidedly puberulent, leaves less so; leaves slightly imbricated, 3–6″ wide, lower obtuse, upper slightly mucronate; vein inconspicuous; pedicel very slightly thickened at the top (not, however, forming a cupule); sepals acute, mucronate, glandular hispid on the margin; central vein prominent, and on outer (sepals) the lateral ones inconspicuous, a little longer (3–4″ long) than the mature capsule (sepals about equal in length to the nearly undi-

* See Bentham and Hooker, Gen. Pl. 1, p. 982.

† STERCULIACEÆ differ from MALVACEÆ by having 2-celled anthers, and from TILIACEÆ by the stamens, when definite in number, being alternate with the sepals, *i. e.*, opposite to the petals, or when indefinite, united more or less at the base into a column.

‡ AYENIA, L.—"Involucel none. Calyx 5-parted. Petals on long capillary claws, connivent over the stigma. Fertile stamens 5, alternating with 1–2-sterile ones, their filaments united into a pedicellate cup. Style single. Stigma 5-angled. Capsule 5-lobed, 5-celled, loculicidally 5-valved, the cells 1-seeded.—Low shrubby plants, with minute axillary flowers. Capsule rough. Albumen none."—CHAPMAN, Flora of Southern U. S. p. 59.

vided style); filaments from an ovoid-triangular base, false partitions entire, membranous; stipular glands evident, (as they are in my specimens of the following species). My specimens are very slightly glaucous. (15.) Gravel hills back of Santa Fé, N. Mex., at 7,050 feet altitude.

LINUM BERLANDIERI, Hook.—Erect, annual, stem distinctly striated, slightly puberulent; lower leaves obtuse, upper slightly mucronate, longer on the average than in the preceding species, which it so closely resembles that I know of no way of distinguishing them, save by the character of the false dissepiments (as indicated by Dr. Engelmann in Pl. Wright. 1, pp. 25 and 26), which, in *L. Berlandieri*, are membranous in the upper and inner half. Under head of *L. Berlandieri*, Dr. Engelmann alludes to a small form collected by Wright on the San Pedro River, which is apparently kept apart from *L. rigidum*, var. *puberulum* (collected on the Cimarron), only by the character of the false partition in the ovary, which is decidedly that of *L. Berlandieri*. I have the precise form (from Santa Fé) he alludes to (so far as can be determined from description), and have, from its partitions and ovate-triangular-based filaments, been obliged to put it under *L rigidum*, var. *puberulum*. Single specimens found by Dr. Loew at Rancheiro Springs, Arizona.

LINUM PERENNE, L.—Widely diffused over Nevada, Utah, Colorado, Arizona, and New Mexico, where it has been obtained by the Expedition; extending, besides, from the Arctic Ocean to Mexico and west to the Pacific.

MALPIGHIACEÆ.*

ASPICARPA† LONGIPES, Gray (Pl. Wright. 1, p. 37).—Stems several,

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*MALPIGHIACEÆ.—"Calyx 5-merous, persistent, segments usually biglandular. Petals 5, usually unguiculate, isostemonous, or diplostemonous, inserted either on the receptacle or on a hypogynous or perigynous disk. Stamens inserted with the petals, usually monodelphous, when several are antherless. Ovary composed of 3 or 2 carpels, connate, or distinct at the top, of 3 or 2, 1-ovuled cells, ovule nearly orthotropous. Fruit a drupe or of 3–2 cocci. Embryo exalbuminous. Stem woody."—LE MAOUT & DECAISNE (English edition).

†ASPICARPA, Lagas.—Flowers dimorphous. *Normal ones*:—Calyx 5-parted, with 10 glands. Petals clawed, fimbriate-ciliate. Stamens 5, 2 perfect, 3 without anthers or the middle one of them with a perfect anther, and the lateral ones with imperfect anthers. Ovaries 3, connate to the axis, style central, apex obliquely truncate. Fruit? [See specific description.] *Abnormal flowers*:—Calyx without glands. Petals none. Anthers single and rudimentary. Ovaries 2, without styles. Nut solitary, either crestless, or with 1-3 slightly prominent dorsal crests, irregularly pyramidal 3-angled. Seed compressed, subreniform, testa membranous, cotyledons obovate, flattish, curved.—Slender, erect, branching shrubs, with the branchlets frequently covered with appressed hairs. Leaves opposite, entire, frequently silky, stipules inconspicuous. *Normal* flowers mostly umbelled, terminal or axillary, rarely solitary, yellow; *abnormal*, axillary, solitary, very small.—BENTHAM & HOOKER.

from a woody root, very slender and wiry, decumbent, somewhat hairy (with the characteristic hairs of the order); leaves on short but distinct petioles, slightly cordate at base, ovate-oblong, very slightly mucronate, pale and veiny beneath, 9–18″ long. *Normal* flowers with 10 large glands on the base of the calyx-lobes; petals clawed, glandular fimbriate above; stamens monodelphous at base only, perfect anthers 3, imperfect (on filaments *about* the same length) 2; "fruit of a single carpel, of nearly the same form as in *A. Hartwegiana*, but more even, with rounded and only slightly margined sides" (Gray); three or four together terminating filiform pedicels on foliaceous or bracted peduncles, or on slender pedicels from the axils of the leaves. *Abnormal* flowers on slender peduncles, which are terminated by a pair of bracts 4″ long and half as wide, from between which the short pedicel and its flower arise. (627.) Sanoita Valley, Southern Arizona.

ZYGOPHYLLACEÆ.*

TRIBULUS† (KALLSTRŒMIA) MAXIMUS, L.—Leaves longer than the pedicels; leaflets, 3–4 pairs, oval, hairy on the lower surface; carpels 10, slightly gibbous below, tuberculate; style 5″ long; sepals lanceolate, tapering into an acute apex, $\frac{2}{3}$ as long as the petals. San Carlos, Ariz. (777.)

TRIBULUS (KALLSTRŒMIA) GRANDIFLORUS, Benth. & Hook. (*Kallstræmia grandiflora*, Torr. in Pl. Wright. 1, p. 26.)—Stem clothed with long, brown, spreading hairs; leaves shorter than the older peduncles, leaflets 4–5 pairs, oblong, slightly falcate; sepals lanceolate-linear, with long, attenuated tips; petals nearly or quite as long as the sepals; carpels less tuberculated on the

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* ZYGOPHYLLACEÆ.—"Calyx 4- to 5-merous, generally imbricate. Petals hypogynous, usually imbricate. Stamens usually double the number of the petals, hypogynous; filaments usually with a scale inside. Ovary several-celled. Fruit a loculicidal capsule, septicidally dividing into cocci. Embryo exalbuminous, or enclosed in cartilaginous albumen.—Scentless plants. Leaves opposite, pinnate, stipulate."—LE MAOUT & DECAISNE (English edition).

† TRIBULUS, *Linn.*—Sepals 5, deciduous, or persistent, imbricated. Petals 5, fugacious, spreading, imbricated. Annular disk 10-lobed. Stamens 10, inserted on the base of the disk, 5 opposite to the petals exterior and usually somewhat longer than the others. 5 alternate with a gland outside of the base, filaments filiform and naked. Ovary sessile, with appressed hairs, 5–12-lobed, 5–12-celled, the cells opposite the petals frequently 3–5-locellate by transverse partitions; style short, pyramidal or filiform; stigmas 5–12; ovules 1–5 in each cell, superposed. Fruit 5-angled, indehiscent. Seeds obliquely pendulous, one in each cell or cellule, testa membranous; embryo exalbuminous, cotyledons oval, radicle short.—Loosely branching herbs, often silky-hairy, and with prostrate branches. Leaves stipulate opposite, sometimes alternate by abortion of one, abruptly pinnate. Flowers solitary, pseudo-axillary, pedunculate, white or yellow.—BENTHAM & HOOKER.

back than in the preceding species, with which it contrasts by its larger flowers, more hispid stem, and more and narrower leaflets. Camp Grant, Ariz. (442.)

LARREA MEXICANA, Moric. (*L. glutinosa*, Engelm.)—(321.) Valley of the Gila, Arizona. (Tab. iii, Torrey, in Emory's Report.) This shrub is especially common on the hills bordering the Gila; also on the sandy wastes adjacent to Tucson and Camp Lowell in Arizona, even imparting its strong odor to the air.

GERANIACEÆ.

GERANIUM RICHARDSONII, Fisch. & Mey.—Very closely allied to *G. maculatum*, L.; differing only in being more smooth, styles hairy and less connate, filaments pilose instead of ciliate, and seeds more delicately reticulated. (408.) Mount Graham, Arizona, at 9,200 feet altitude. Also a more white-flowered and more pilose form (234) from Willow Spring, Ariz., at 7,195 feet altitude. Nevada and Utah; Colorado (758).

GERANIUM FREMONTII, Torr. (Pl. Fendl. p. 26).—Much branched, 6′–2° high, pubescent or glabrous; upper stem-leaves 3–5-cleft, truncate at base, lower broadly cordate; root-leaves 7-cleft; peduncles 1–2′ long; pedicels in pairs, 1–1½′ long; sepals oval, with a short, thick awn; fruiting pedicels *sometimes* divaricate, or deflexed; petals obovate, varying from light to deep purple, 1′ in diameter, villose on the veins; filaments at base pilose-ciliate; styles united below; seeds somewhat reticulated. Plant forms branching, luxuriant tufts. Hard to limit by a description, yet usually readily recognized. Sanoita Valley, Arizona. No. 279, from Rocky Cañon, Arizona, I had doubtfully assigned here. Mr. Watson assures me, that, though usually placed under *G. cæspitosum*, it is really *G. Eremontii*. It has the stamens of *cæspitosum*, and is besides quite smooth.

GERANIUM CÆSPITOSUM, James.—Perennial, 4′–1° high; stems branching from the base; these, with the petioles and pedicels, retrorsely pilose or pubescent; peduncles several times longer than the 1–2′ long pedicels; flowers *about* an inch in diameter, deep purple. Readily distinguished from the preceding species by its stamens, which are almost as long as the petals, and during flowering are outwardly recurved. Santa Fé. (21.)

Some forms resemble *G. Fremontii* closely, South Park, Colorado, (759), Utah.

ERODIUM CICUTARIUM, L. Her.—Santa Fé, N. Mex. (36 *a.*)

OXALIS VIOLACEA, L.—Mount Graham, Arizona, at an altitude of 9,250 feet. (437.)

RUTACEÆ.

CANOTIA* HOLOCANTHA, Torr. (in Pacific R. R. Rep. iv, 68). Benth. and Hook. 1, 616.—A much branched, leafless tree, 20° high and trunk 1° in diameter; branchlets yellowish-green, delicately striate; sparingly dotted with very minute brown scales, which represent reduced leaves; flowers white or yellowish white; pedicels articulated; bracts small and scale-like; *minute* cil-glands sparingly seen on the bracts, sepals, and petals. Gila Valley, Arizona. (323.) PLATE I.†

From Camp Bowie, Arizona, I have (499) a PTELEA, probably ANGUSTIFOLIA, Benth.

CELASTRINEÆ.

PACHYSTIMA MYRSINITES, Raf.—Utah, 5,000 to 7,000 feet altitude. Quite recently, the indefatigable Mr. Canby has brought to light a second species of this genus (*P. Canbyi*, Gray), in Giles County, Virginia. "While the original *P. Myrsinites* occurs plentifully in most wooded districts from the

* CANOTIA, Torr.—"Flowers hermaphrodite. Calyx small, 5-lobed, persistent; the broad lobes imbricated in æstivation. Petals 5, hypogynous, oblong, very obtuse, at base with a broad insertion, imbricated in æstivation, with a rather prominent midrib inside, deciduous. Stamens 5, hypogynous, opposite to the calyx lobes: filaments subulate, somewhat shorter than the petals, persistent: anthers oblong-cordate, introrse, affixed to the filaments in the acute apex of a deep sinus, apiculate with a small mucro; cells inwardly longitudinally dehiscent. Dried pollen becomes 3-horned when moistened. Disk none. Ovary placed on a gynobase (*at first thicker than itself*), 5-celled, the thick style at length elongating: stigma small, slightly 5-lobed; cells of the ovary opposite to the petals. Ovules in the cells most frequently 6, subhorizontally inserted in two series in the inner angle [amphitropous]: micropyle inferior. Capsule ovate-fusiform, somewhat woody, covered with a delicate, somewhat fleshy epicarp, 5-celled, 10-valved at the apex (at first septicidal and later loculicidal), terminated by 10 split portions of the persisting style; columella none. Seeds 1–2, filling the cell, ascending, subovate, flattened; testa subcoriaceous, thickly papillulose, produced below into a broad membranous wing somewhat longer than the nucleus. Embryo straight, in a thin layer of fleshy albumen; cotyledons oval, flat; the shortish radicle inferior." My own specimens showing only the flowers and immature fruit, I have been obliged to quote the above from Dr. Gray's complete description, recently published in Proc. Amer. Acad. xii, pp. 159–160.

† Branch; natural size. Fig. 1. A cross section of a flower. Fig. 2. An open flower. Fig. 3. A longitudinal section of flower. Fig. 4. An inside view of stamen. Fig. 5. An outside view of stamen. Fig. 6. The young fruit; petals fallen and filaments remaining. Fig. 7. A vertical section through a young ovary. Fig. 8. A young ovule. Fig. 9. A vertical section of mature fruit. Fig. 10. A cross section of fruit. Fig. 11. A seed. Fig. 12. A diagonal section of a seed. All except the branch magnified about five diameters.

Rocky Mountains to the Pacific, in Northern California and Washington Territory, this is only known at one station in the Alleghany Mountains, and makes an addition to the list of those few genera (such as *Boykinia* and *Calycanthus*), which are divided between Eastern and Western North America."—(GRAY, Proc. Am. Acad. viii, pp. 623–624.)

RHAMNEÆ.

ZIZYPHUS* LYCIOIDES, Gray, var. CANESCENS, Gray.—A much branched shrub, 4–5° high; younger branches covered with a light gray powdery substance, which is readily scraped away, leaving the green epidermis exposed beneath; leaves oval, obtuse, pubescent (especially beneath); petioles 2–4″ long; spiny branches ½–1′ long, thick, terminating *abruptly* in a point. More or less leafy; flowers greenish. Valley of the Gila, Arizona, at 3,080 feet altitude. (331.)

KARWINSKIA† HUMBOLDTIANA, Zucc. (Gray, Pl. Wright. 1, p. 32).—Shrub from 2–12° high, leaves oval and beautifully penninerved [Flowers not seen.] Drupe ovoid, 4–5″ long, pointed with the remains of the style, cup or disk-like calyx terminating the pedicel after the drupe has fallen. Plant appears to vary much in the shape of the leaves and in the number of flowers in the axillary clusters. Arizona.

RHAMNUS CROCEA, Nutt. (T. & G. Fl. N. Am.).—"Low, branches

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* ZIZYPHUS, Juss.—Calyx 5-cleft, tube broadly obconical, lobes triangular-ovate, acute, spreading, carinate within. Petals 5 (rarely 0), hooded, deflexed. Disk flat, 5-angled, margin free Stamens 5, included or longer than the petals, filaments subulate. Ovary immersed in the disk and at the base confluent with it, 2-, rarely 3-, most rarely 4-celled; styles 2–3, conical, free or connate, divergent, stigmas small, papillose. Drupe fleshy, globose or oblong, putamen woody or bony, 1–3-celled, 1–3-seeded. Seeds plano-convex, testa thin, fragile, and smooth, albumen little or none; cotyledons thick; radicle short.—Shrubs or trees decumbent, or with many small branches, often with strong, hooked spines. Leaves sub-distichous, alternate, petiolate, coriaceous, entire or crenate, 3–5-nerved. Stipules both spinescent or one caducous, hooked or straight, cymes short, axillary, few-flowered. Flowers small, greenish. Fruit often edible.—BENTHAM & HOOKER.

† KARWINSKIA, Zucc.—Calyx 5-cleft, tube hemispherical or turbinate, acute lobes 3-angled, keeled or with the keel produced within and above into a spur. Petals 5, short-clawed and hooded. Stamens longer than the petals, filaments subulate. Disk lining the tube of the calyx, delicate limb free. Ovary sub-globose, immersed in the disk, free, 2–3-celled, septa parting in the middle, often attenuated (the ovary) into a triangular style, with the apex 2–3-lobed, stigmas obtuse, papillose; ovules 2 in each cell, parallel, curved downward. Drupe sub-globose or ovoid, apiculate with the persistent style, surrounded at base by the calyx, putamen 1–2-celled, each cell 1-seeded. Seeds erect, obovate, testa membranous, dark-verrucose, raphe elevated, albumen in a thin fleshy stratum adherent to the testa; cotyledons oval, fleshy; radicle very short.—Small trees and shrubs. Leaves sub-opposite, petiolate, oblong, entire, penninerved, pellucidly punctulate. Stipules membranous, deciduous. Flowers axillary, racemose or cymose. Cymes fasciculate.—BENTHAM & HOOKER.

spinescent; leaves thick, evergreen, obovate, ½′ long; petiole 1–2″ long, glandularly denticulate; flowers diœcious, apetalous, styles distinct above. A thorny shrub with yellow wood, imparting its color to water." Arizona. I have not seen the plant.

CEANOTHUS FENDLERI, Gray.—Shrub, with stiff, and often spine-tipped, gray branches; leaves thickish, tomentose pubescent beneath, smoother on upper surface, lanceolate to oval, 5–12″ long, usually cuneate at base, petioles 1–3″ long; small white flowers in paniculate racemes terminating the branches. New Mexico (143). Camp Apache, Ariz. (257), at 4,900 feet.

AMPELIDEÆ.

VITIS ÆSTIVALIS, Michx., var.?—"Resembling a common Texan and New Mexican form; perhaps *V. Arizonica*, Engelm. Arizona."—S. WATSON.

AMPELOPSIS QUINQUEFOLIA, Michx. (*Vitis*, Bentham & Hooker, Gen. Plant.)—New Mexico. (110.)

SAPINDACEÆ.

SAPINDUS* MARGINATUS, Willd.—Tree 10–30° high; leaves 4–8′ long, leaflets thickish, shining, plainly penninerved, lanceolate, tapering into a long point, inæquilateral, somewhat falcate; flowers in compound terminal and axillary panicles; fruit globose, 6″ in diameter. Arizona, in the dryer portions. (301.) "Soapberry."

ACER GLABRUM, Torr.—Mountain streams of Colorado. The name *A. tripartitum*, Nutt., would have been much more appropriate. (1.)

ACER GRANDIDENTATUM, Nutt.—(303.) Ash Creek, Arizona, at 4,684 feet altitude. Utah.

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* SAPINDUS, Linn.—Flowers polygamous, regular. Sepals 4–5, 2-seried, imbricated. Petals 4–5, naked or with 1–2 glabrous or villous scales within, produced into a claw above. Disk complete, annular or elevated. Stamens 8–10 (rarely 4–7 or more), filaments free, frequently pilose; anthers versatile. Ovary entire or 2–4-lobed, 2–4-celled; style terminal, stigma 2–4-lobed; ovules solitary in each cell, ascending from the base of the interior angle. Fruit fleshy or coriaceous, with 1–2, (rarely) 3–4 cocci, which are oblong or globose and indehiscent. Seeds usually globose, destitute of an aril, testa crustaceous or membranous; embryo straight or curved, cotyledons thick, radicle short.—Trees or shrubs. Leaves alternate, without stipules, simple, 1-foliate, or abruptly pinnate, with the leaflets entire, or rarely serrate. Racemes or panicles either terminal or axillary. Fruit dry or baccate.—BENTHAM & HOOKER.

NEGUNDO ACEROIDES, Mœnch.—Santa Fé, N. Mex., along water-courses at 7,044 feet altitude. (20.) Arizona and Utah.

ANACARDIACEÆ.

RHUS VIRENS, Lindh. (Pl. Lindh. 2, p. 159).—Shrub, 4–6° high, with bark much resembling *Kalmia latifolia;* leaflets (in my specimens) 3–5, rigidly coriaceous, inæquilateral (terminal one largest), entire and under surface thickly sprinkled with black dots; sepals and subtending bracts tinged with red, petals white, flowers in a thyrsoid panicle, which is shorter than the leaves; "drupe red, hairy, putamen lenticular and smooth." Rocky ledges on east side of Santa Rita Mountain, Arizona, at 5,700 feet altitude. (645.) Resembling in all respects the specimens obtained by the Mexican Boundary Survey, save that in the Boundary specimens there are 7–9 leaflets.

RHUS GLABRA, L.—Chiricahua Agency, Arizona, at an altitude of 5,310 feet. (533.) Utah.

RHUS AROMATICA, Ait., var. TRILOBATA, Gray. (*Rhus trilobata*, Nutt.)—(203.) Willow Spring, Ariz. Utah.

RHUS INTEGRIFOLIA, Benth. & Hook. (*Styphonia, Nutt.*)—A small, much branching tree, with oval, obtuse, entire leaves, which are 1′ or more long, petioles 4″ long; sepals and petals reddish; hairy drupes the size of a pea. Arizona. I have not seen specimens.

RHUS TOXICODENDRON, L.—Willow Spring, Ariz., at 7,195 feet altitude. (254.)

LEGUMINOSÆ.

BY SERENO WATSON.

SUBORDER I. **PAPILIONACEÆ.** Flowers irregular, perfect. Perigynous disk lining the bottom of the campanulate or tubular 5-cleft or toothed calyx and bearing the petals and stamens. Petals 5 (rarely fewer), imbricated, the upper one larger and exterior. Stamens 10 (rarely 5), diadelphous (9 and 1), or monadelphous, or rarely distinct. Seeds without albumen. Radicle inflexed. Leaves simple or simply compound.

I. *Stamens distinct.*

* Leaves digitately 3-foliolate; stipules conspicuous: pod flat, 2-valved.

THERMOPSIS. Perennial herb. Flowers yellow, racemose. Pod linear, straight, several-seeded.

** Leaves unequally pinnate; stipules small or none: pod turgid, mostly indehiscent and few-seeded.

SOPHORA. Perennial herb. Flowers white, racemose. Pod terete, moniliform, few-seeded.

AMORPHA. Shrub, glandular-dotted. Flowers purple, racemose; wings and keel wanting: stamens monadelphous at base. Pod 1–2-seeded.

PARRYELLA. Glandular shrub. Flowers spicate: petals none. Pod 1-seeded.

II. *Stamens monadelphous or diadelphous.*

* Anthers of two forms: stamens monadelphous: leaves digitate, of 3 or more entire leaflets: pods dehiscent. Herbs or shrubby, not glandular-dotted nor climbing.

CROTALARIA. Calyx 5-lobed. Pod inflated. Leaflets 3.

LUPINUS. Calyx 2-lipped. Pod flattened. Leaflets 5 or more.

** Anthers mostly uniform. Not climbing.

† Leaflets 3 (rarely digitately 5 or 7), toothed: stamens diadelphous: pods small and mostly included in the calyx (strongly coiled in *Melilotus*).

MEDICAGO. Flowers in long axillary racemes or spikes; petals free, deciduous. Style filiform. Pod small, wrinkled.

MELILOTUS. Flowers as in *Medicago*. Style subulate.

TRIFOLIUM. Flowers capitate; petals persistent, united with the filaments.

†† Leaves pinnately 3-many-foliolate (very rarely digitate or simple in *Hosackia*); leaflets entire: pod not articulated.

‡ Flowers umbellate or solitary, on axillary peduncles: stamens diadelphous: herbage not glandular-punctate.

HOSACKIA. Herbaceous or shrubby. Petals yellow or yellowish, turning brownish; claw of the standard remote from the rest.

‡‡ Flowers spicate or racemose: stamens diadelphous: herbs not glandular-punctate (except in *Glycyrrhiza*): pod dehiscent.

TEPHROSIA. Peduncles terminal. Standard hairy. Pod flat, 1-celled.

INDIGOFERA. Peduncles axillary. Standard hairy. Pod linear, terete, 2-celled. Connective of the anthers gland-tipped.

ASTRAGALUS. Peduncles axillary. Standard naked; beak of the keel not erect or recurved. Pod often bladdery or turgid, 1-celled, or more or less 2-celled by the intrusion of the dorsal suture.

OXYTROPIS. Like *Astragalus*, but the keel with an erect or recurved beak, and pod partially 2-celled by intrusion of only the ventral suture.

GLYCYRRHIZA. Like *Astragalus*, but anthers confluently 1-celled, pod armed with prickles and 1-celled, and leaves more or less glandular and punctate.

‡‡‡ Flowers spicate or racemose: stamens mostly monadelphous or distinct: pods indehiscent, small and few-seeded. Herbs or shrubs, mostly glandular-punctate.

PSORALEA. Perennial herbs, with 3-foliolate leaves and axillary spikes. Stamens monadelphous or somewhat diadelphous. Pod 1-seeded.

AMORPHA. Shrubs, with pinnate leaves and terminal racemes. Wings and keel wanting. Stamens united only at base. Pod 1–2-seeded.

PETALOSTEMON. Herbs, with pinnate leaves and terminal spikes. Stamens 5, monadelphous, bearing 4 of the petals on the tube. Pod 1-seeded.

PARRYELLA. Shrubby, with pinnate leaves and terminal spikes. Stamens 10, distinct. Petals none. Pod 1-seeded.

DALEA. Shrubs or herbs, with pinnate leaves and terminal spikes or heads. Stamens 10, monadelphous, the petals jointed to the tube. Pod 1–2-seeded.

††† Leaves pinnately 3–many-foliolate (digitately 2–4-foliolate in *Zornia*); leaflets entire: pod transversely 2–several-jointed, the joints indehiscent and 1-seeded. Herbs.

HEDYSARUM. Leaflets several, stipellate; stipules scarious. Stamens diadelphous. Perennial, with axillary racemes.

ZORNIA. Leaflets 2; stipules herbaceous. Stamens monadelphous. Flowers spicate, each solitary and sessile between a pair of conspicuous bracts. Annual.

DESMODIUM. Leaflets 3; stipules dry and striate. Stamens usually monadelphous. Racemes simple or panicled.

*** Anthers uniform. Herbs, climbing by tendrils or twining, sometimes prostrate: stamens diadelphous: pod flat, 2-valved: racemes axillary (or flowers axillary in *Cologania* and *Rhynchosia*).

† Leaves abruptly pinnate, terminated by a tendril: seed-stalks broad at the hilum.

VICIA. Stamen-tube oblique at the mouth. Style filiform, hairy around and below the apex.

LATHYRUS. Stamen-tube nearly truncate. Style dorsally flattened, usually twisted half around, hairy on the inner side.

†† Twining or prostrate herbs, with 3-foliolate leaves.

‡ Flowers not yellow: seeds several.

COLOGANIA. Calyx tubular. Style naked. Bracts persistent.

GALACTIA. Calyx 4-cleft. Keel nearly straight. Style naked. Bracts minute or caducous.

PHASEOLUS. Calyx short. Keel strongly incurved and standard reflexed. Style bearded. Bracts minute or caducous.

‡‡ Flowers yellow, axillary: seeds 1 or 2.

RHYNCHOSIA. Flowers small. Style naked. Leaves often resinous-dotted.

SUBORDER II. CÆSALPINEÆ. Flowers more or less irregular, perfect. Perigynous disk lining the base of the short calyx-tube. Petals 5, imbricated, the upper one included. Stamens 10 or fewer, distinct. Seeds sometimes albuminous. Radicle not inflexed.

* Leaves bipinnate; leaflets small: anthers 10, versatile, dehiscing longitudinally: calyx slightly imbricate or valvate.

HOFFMANSEGGIA. Low herbs or woody at base. Pod flat. Seeds without albumen.

PARKINSONIA. Somewhat spinescent shrubs or trees. Pod more or less torulose. Seeds albuminous.

** Leaves simply and abruptly pinnate: anthers 10 or fewer, fixed by the base, opening by terminal pores: calyx imbricated.

CASSIA. Herbs or woody at base. Pods rather thick or flat. Seeds albuminous.

SUBORDER III. MIMOSEÆ. Flowers regular, small, in spikes or heads, perfect or polygamous. Calyx and corolla valvate, 4–6-toothed or divided. Perigynous disk none. Stamens as many or twice as many as the lobes of the corolla, or numerous, hypogynous. Seeds mostly without albumen. Radicle not inflexed. Leaves usually bipinnate.

* Stamens twice as many as the petals or just as many: pollen-grains numerous.

PROSOPIS. Shrubs or trees, more or less spiny. Petals distinct or becoming so. Flowers greenish, in heads or cylindrical spikes. Pod straight or coiled, at length thick and pulpy within.

DESMANTHUS. Herbs, unarmed. Flowers purplish, in globose heads. Pod flat and thin, not jointed, 2-valved.

MIMOSA. Herbs or shrubs, armed with prickles. Flowers in heads or short spikes. Valves of the pod separating from the persistent margins, entire or jointed.

** Stamens numerous: pollen-masses 4 to 6 in each anther-cell.

ACACIA. Shrubs or small trees, usually armed. Flowers capitate or spicate, yellow. Stamens distinct. Pod flat, 2-valved.

CALLIANDRA. Herbaceous or shrubby, unarmed. Flowers capitate. Stamens united at base into a tube, long-exserted, purple or white. Pod dehiscing elastically from the apex downward.

THERMOPSIS* MONTANA, Nutt. (Torr. & Gray, Fl. i, 300). (*T. fabacea*, DC., var. *montana*, Gray.)—Somewhat silky-pubescent, at least on the under surface of the leaves: leaflets oblong-obovate to narrowly oblong, obtuse or acutish, smooth above, one to three inches long; stipules ovate to lanceolate, exceeding the petioles: bracts oblong to linear-lanceolate: pod linear, straight, erect, pubescent, two or three inches long and 10–12-seeded, on a stipe shorter than the calyx-tube.—On stream-banks in the mountains, from Wyoming Territory to New Mexico and westward to Oregon; Northern Nevada, 1871; Denver, Colo. (201).

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*THERMOPSIS, R. Brown.—Calyx campanulate, equally cleft to the middle, or the two upper teeth united. Standard broad, shorter than the straight wings, the sides reflexed. Stamens distinct; anthers uniform. Pod coriaceous, linear to oblong-linear, flattened, few–many-seeded, nearly sessile.—Stout perennial herbs, with digitately 3-foliolate leaves on short petioles; leaflets entire and stipules foliaceous; flowers large, yellow, in terminal racemes, with persistent herbaceous bracts.

SOPHORA* SERICEA, Nutt. (Gen. i, 280).—Appressed silky-pubescent: stems herbaceous, from a perennial running rootstock, erect, a foot high or less, branching: leaflets six to ten pairs, oblong-obovate, obtuse or retuse, glabrous above, two to six lines long; stipules linear or wanting: racemes shortly peduncled, rather loose, short; bracts subulate, somewhat persistent, about equalling the pedicels: calyx 5-toothed: petals white, four to six lines long; the standard longer, recurved, and with a narrow claw: pods pubescent, more or less stipitate, thin-coriaceous, scarcely dehiscent, 1–3-seeded (about 6-ovuled), an inch or two long.—Colorado to New Mexico, frequent; collected at Kit Carson and Apex, Colo. (238), and at McArthy's Ranch, N. Mex. (98).

CROTALARIA LUPULINA, DC. (Prodr. ii, 133).—Annual and finely pubescent or glabrate: stem slender, erect or ascending, one-half to two feet high, branching: leaves digitately 3-foliolate; leaflets cuneate-oblong, obtuse, mucronulate, smooth above, a half to one and a half inches long, exceeding the petioles; stipules setaceous: peduncles terminal and opposite the leaves, loosely flowered: bracts minute: pedicels recurved: calyx two lines long or less: petals three to six lines long, the keel with a long straight beak: pod oblong, half an inch long.—From New Mexico and Arizona to Northern Mexico, and also in Cuba; collected by Rothrock, in Arizona, at Camp Grant (443), Chiricahua Agency (534), and Camp Crittenden (684). Grisebach refers the species to *C. pumila*, Ortega.

LUPINUS SITGREAVESII, Watson (Proc. Am. Acad. viii, 527).—Perennial, herbaceous, slender, leafy and branching, about two feet high, more or less silky-villous; pubescence of the racemes short and spreading: leaflets 7 to 9, narrowly oblanceolate, usually glabrous above or nearly so, equalling the petioles: raceme open, shortly peduncled: flowers rather large, light blue, on slender pedicels: calyx broad, not spurred: standard naked; keel usually ciliate: pod 5-seeded.—In the mountains from the Southern Sierra Nevada to Southern Colorado and New Mexico; San

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*SOPHORA, Linn.—Calyx campanulate, with short equal teeth. Petals nearly equal; standard broad. Stamens distinct; anthers uniform. Pod thick or coriaceous, terete, stipitate, mostly indehiscent, constricted between the several sub-globose seeds and usually necklace-like.—Trees, shrubs, or herbs, with unequally pinnate leaves and entire leaflets; stipules small or none; flowers in terminal racemes.

Francisco Mountains, 1871; Willow Spring, Ariz., Loew (1115); Rocky Cañon, Ariz., Rothrock (285). An apparently variable species of somewhat uncertain limits.

LUPINUS PARVIFLORUS, Nutt.—In the Sierra Nevada and northward to the Columbia, and also in the Wahsatch Mountains, where it was collected in 1871.

LUPINUS LAXIFLORUS, Dougl.—From Washington Territory to Nevada and Utah; in the Wahsatch, 1871.

LUPINUS ARGENTEUS, Pursh.—Perennial, herbaceous, with short appressed silky pubescence, the numerous stems rather low, leafy, much branched, often decumbent at base: leaflets 5 to 8, narrowly oblanceolate, smooth above or nearly so, equalling the short petioles: racemes nearly sessile, short: flowers small, blue or whitish, on slender, usually short pedicels: calyx broad, somewhat gibbous: petals naked or nearly so: pods 3–5-seeded.—Oregon to Montana; at Mosquito Pass, Colo., Wolf (196).

Var. DECUMBENS, Watson, *l. c.* 532, rather stout, with denser racemes, and var. ARGOPHYLLA, Watson, *l. c.*, more silky-pubescent, and nearly equally so on both sides of the leaves, the flowers larger, and the calyx decidedly spurred, are both very common in the Rocky Mountains from Montana to New Mexico. The first was collected near Gray's Peak by Wolf (197, 202), at Rancheria Springs, Ariz., Loew (199), and at Sulphur Springs, Southern Arizona, Rothrock (543), the latter specimens closely approaching the typical form; var. ARGOPHYLLA at Santa Fé, N. Mex., Rothrock (1, 59).

LUPINUS HOLOSERICEUS, Nutt.—Much resembling the latter variety of the last species, but more densely appressed white-silky throughout, the standard hairy upon the back, and the keel ciliate.—On the eastern side of the Sierra Nevada from Oregon to Southern Nevada and Utah, where it was collected in 1871.

LUPINUS LEUCOPHYLLUS, Dougl.—From Oregon to Utah and New Mexico; collected in the Wahsatch in 1871.

LUPINUS CÆSPITOSUS, Nutt.—Perennial, dwarf, the stems very short and cespitose: pubescence appressed-villous: leaflets 5–7, oblanceolate, several times shorter than the petioles: racemes sessile, short, dense: bracts long,

persistent: flowers small, purple, nearly sessile: standard narrow; keel ciliate: pod very short, 3–4-seeded.—From Wyoming to Colorado and Utah; on Blue River, Colorado, Wolf (200).

Lupinus pusillus, Pursh.—From the Upper Missouri to the Columbia and southward through the interior; Denver, Wolf (198).

Lupinus Kingii, Watson (Proc. Am. Acad. viii, 534). (*L. Sileri*, Watson, same, x, 345.)—Resembling the last, but more slender and villous with soft white hairs: racemes very short, few-flowered, on long slender peduncles: pods and seeds smaller.—Utah and Colorado; at Loma, on the Rio Grande, Wolf (195).

Medicago sativa, Linn.—Santa Fé, N. Mex., naturalized in the Plaza, Rothrock (65). Known as "*Alfalfa*".

Melilotus parviflora, Desf. "Sweet Clover."—Camp Lowell, Ariz., Rothrock (710, 716).

Melilotus alba, Lam.—Collected in Utah, 1871.

Trifolium megacephalum, Nutt. (Gen. ii, 105).—Perennial, very stout, rather low, somewhat villous: leaflets 5 to 7, obtuse, nearly an inch long; stipules ovate-oblong: flowers rose-colored, sessile in very large naked terminal heads: calyx-teeth filiform, plumose: ovary smooth, 6-ovuled.—From Washington Territory to Northeastern California and Nevada; Diamond Range, Northern Nevada, 1871.

Trifolium longipes, Nutt. (Torr. & Gray, Fl. i, 314).—Frequent from the Rocky Mountains to the Pacific; Mogollon Mesa, Loew (179).

Trifolium nanum, Torrey (Ann. N. Y. Lyc. i, 35, t. 3).—In the Rocky Mountains and Wahsatch; South Park, at 13,000 feet altitude, Wolf (175, 874).

Trifolium Parryi, Gray (Am. Journ. Sci. 2d ser. xxxiii, 409).—In the Rocky Mountains and Wahsatch; at Twin Lakes, in South Park, Wolf (177, 184).

Trifolium dasyphyllum, Torr. & Gray (Fl. i, 315).—In the Rocky Mountains and Wahsatch; on Gray's Peak and in South Park, Wolf (182, 183).

Trifolium involucratum, Willd.—Annual, glabrous, the ascending stems often a span high or more: leaflets usually oblanceolate, acute, a

half to an inch long: flowers purple or rose-colored, half an inch long, sessile in close heads, involucrate: involucre deeply lobed, the lobes laciniately and sharply toothed: calyx-teeth thin, long and narrow, entire: ovules mostly 5 or 6.—Var. HETERODON, Watson (Proc. Am. Acad. viii, 130), with usually larger heads and broader leaflets; some of the calyx-teeth setaceously cleft.—A very common species west of the Rocky Mountains, ranging from British America to Mexico, the variety nearer the coast. The typical form was collected in the valley of the Upper Arkansas, Colorado, Wolf (176); at Santa Fé, N. Mex., Rothrock (63); in Western New Mexico, Loew; at Zuñi Village, N. Mex., Rothrock (172); at Willow Spring, Ariz., Rothrock (229). A form with the small involucre cleft nearly to the base was found in Zuñi River Cañon (178), and on Mount Graham, Rothrock (432).

TRIFOLIUM MONANTHUM, Gray (Proc. Am. Acad. vi, 523).—Annual, very slender, low and often dwarf, more or less villous: leaflets obcordate to oblanceolate, mostly retuse: flowers 1 to 4, white or purplish, with a very small 2–3-parted involucre, much longer than the calyx: calyx-teeth not rigid, subulate, shortly acuminate.—In the mountains of Nevada, 1871.

HOSACKIA* PUBERULA, Benth. (Pl. Hartw. 305).—Perennial, herbaceous, usually a span high or more, canescently puberulent, slender: leaflets 3 to 5 upon a short rhachis, linear-oblanceolate, 6 to 9 lines long; stipules gland-like: peduncles exceeding the leaves, 1–5-flowered, with or without a sessile 1–5-foliolate bract: flowers half an inch long, yellow: calyx-teeth about equalling the tube: pod nearly straight, an inch long, pubescent, many-seeded.—New Mexico to Arizona; Rancheria Springs, Loew (119), and Sanoita Valley, Arizona, Rothrock (659).—*H. rigida*, Benth., is a form with the rhachis of the leaves very short or wanting, and the leaflets usually somewhat broader.

HOSACKIA WRIGHTII, Gray (Pl. Wright. ii, 42).—Like the last, but the peduncles wanting, the flowers being solitary in the axils upon a short pedi-

*HOSACKIA, Dougl.—Calyx-teeth nearly equal. Petals free from the stamens, nearly equal; standard often remote from the rest, ovate or roundish; keel curved, obtuse or somewhat acutely beaked. Stamens diadelphous; anthers uniform. Pod linear, compressed or nearly terete, sessile, several-seeded, with partitions between the seeds.—Herbaceous or rarely woody, with pinnate 2-many-foliolate leaves; stipules mostly minute and glandlike; flowers in axillary sessile or pedunculate umbels, yellow, often becoming brownish.

cel, or rarely shortly pedunculate: leaflets mostly linear, palmate upon a very short petiole or sessile.—New Mexico and Arizona; Willow Springs, Loew (1114), and White Mountains, Arizona, Loew (1113), and Fort Wingate, N. Mex., Rothrock (152).

Hosackia Purshiana, Benth.—Annual, usually a foot high or more, and more or less silky-villous: leaflets 1 to 5, ovate to narrowly lanceolate, 2 to 9 lines long; stipules gland-like: flowers small, yellow, on peduncles exceeding the leaves, bracteate with a single leaflet: calyx-teeth linear, much exceeding the tube, about equalling the corolla: pod linear, straight, smooth, an inch long, 5–7-seeded.—Frequent from the Mississippi to the Pacific; Nevada, 1871, and Camp Grant, Ariz. (368).

Tephrosia leiocarpa, Gray (Pl. Wright. ii, 36).—Perennial, erect, rather stout, a foot high or more, with a fine, appressed, silky pubescence: leaflets 6 to 10 pairs, linear-oblong, obtuse, mucronate, smooth above, shortly petiolulate, about an inch long: peduncles terminal and axillary, scarcely exceeding the leaves, rather few-flowered: calyx-lobes subulate, as long as the tube; petals large, purple, 9 lines long: pods linear, straight, glabrous, two inches long by three lines wide, sessile, about 10-seeded.—Arizona, Sanoita Valley, Rothrock (685), near the original locality, where only it had been collected by Mr. Wright.—Very near *T. onobrychoides*, Nutt. Differing in its short peduncles and smooth pods.

Tephrosia leucantha, H. B. K. (Nov. Gen. vi, 460, t. 577).—Perennial, erect or ascending, rather stout, about a foot high, appressed-pubescent and somewhat rusty silky-villous throughout, the hairs upon the petioles spreading: leaflets 5 to 12 pairs, oblong, rounded at each end, mucronate, an inch long: raceme terminal, short and shortly peduncled: flowers yellow, 6 or 7 lines long, exceeding the erect slender pedicels: calyx very villous, the slender lower teeth longer than the tube: style pubescent: pods narrowly linear, straight, spreading, densely rusty pubescent with short spreading hairs.—Southern Arizona, apparently identical with the typical form of Central Mexico; in Sanoita Valley, Rothrock (625).

Tephrosia tenella, Gray (Pl. Wright. ii, 36)—Annual, erect, very slender, a span high or less, nearly glabrous: leaflets 1 to 3 pairs, thin, linear, obtuse, mucronate, an inch long: flowers few, in an interrupted

long-pedunculate raceme, purple, 3 lines long, on short pedicels, the lowest often subtended by a leaf: calyx-teeth subulate, equalling the tube: pods spreading, linear, straight, puberulent, an inch long, 4–6-seeded.—Southern Arizona, in Sanoita Valley, Rothrock (632 in part).

INDIGOFERA* LEPTOSEPALA, Nutt. (Torr. & Gray, Fl. i, 298).—Annual, canescently pubescent, usually decumbent; stems a foot or two long: leaflets 3 or 4 pairs, cuneate-oblong, obtuse, a half to an inch long, sometimes smoother above: flowers nearly sessile, scattered in long-pedunculate racemes exceeding the leaves: petals pale scarlet, 4 or 5 lines long, nearly twice longer than the slender calyx-teeth: pods linear, terete, straight, pubescent, reflexed, an inch long or more, 6–9-seeded.—From Arizona and New Mexico eastward to the Atlantic; in Arizona, 1871 or 1872, locality not given.

ASTRAGALUS CARYOCARPUS, Ker.—From the Saskatchewan to Texas; at Denver, Wolf (232).

ASTRAGALUS LENTIGINOSUS, Dougl. (Hook. Fl. i, 151), and var. FREMONTI, Watson, more hoary-pubescent; stem flexuous.—From Washington Territory through the interior to Southern Nevada; both forms were collected in Nevada, 1871.

ASTRAGALUS DIPHYSUS, Gray (Pl. Fendl. 34).—Scarcely more than a glabrous form of the last, with rather larger flowers; the pods usually larger and with somewhat thicker walls.—Northern Nevada to New Mexico; in Nevada, 1871, and New Mexico, Rothrock (183).

ASTRAGALUS CANADENSIS, Linn.—From Winnipeg Valley to Washington Territory, Northern Utah, and the Atlantic; in the Wahsatch, 1871.

ASTRAGALUS ADSURGENS, Pall. (Astrag. 40, t. 31).—From Winnipeg Valley to Nebraska and Colorado; South Park, Wolf (336).

ASTRAGALUS HYPOGLOTTIS, Linn.—New Mexico to the Arctic Circle and Alaska; at Apex and South Park, Colorado, Wolf (231, 242, 867).

ASTRAGALUS DRUMMONDII, Dougl. (Hook. Fl. i, 153, t. 57).—Perennial,

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* INDIGOFERA, Linn.—Calyx broad and short, oblique; teeth nearly equal. Standard ovate or orbicular; keel subulately spurred on each side. Stamens diadelphous; anthers uniform, glandular-apiculate. Style glabrous: stigma capitate. Pod globose to linear, 2-celled, 1-many-seeded, with partitions between the truncate seeds.—Herbaceous or shrubby, more or less pubescent with appressed hairs attached by the middle; leaves mostly unequally pinnate, with setaceous stipules; flowers in axillary racemes or spikes, usually rose-colored or purple.

villous throughout with spreading hairs, very stout, a foot or two high: leaflets 10 to 15 pairs, cuneate-oblong to linear, 6 to 9 lines long, often retuse: flowers in long and long-peduncled racemes, ochroleucous, about nine lines long, on rather slender pedicels: pods coriaceous, linear and exsertly stipitate, an inch long, terete or somewhat compressed, with a deep narrow dorsal furrow, and 2-celled or nearly so, smooth, nearly straight, reflexed.—From the Saskatchewan to Nebraska and Colorado; at Apex, Colo., Wolf (215).

Astragalus racemosus, Pursh (Fl. ii, 740).—Resembling the last, but glabrous or somewhat appressed-pubescent: pedicels slender: pod somewhat broader and more compressed.—From Nebraska to Southern Colorado and Idaho; at Apex (216) and South Park, Colo., Wolf (227, 251).

Astragalus humistratus, Gray (Pl. Wright. ii, 43).—Perennial, somewhat villous-pubescent with mostly appressed hairs: stems slender, procumbent, a foot long or more: leaflets 5 to 10 pairs, linear-oblong, acute, half an inch long: flowers nearly sessile in a loose long-peduncled raceme, spreading, 4 lines long, purplish: calyx-teeth equalling or exceeding the campanulate tube: pods coriaceous, sessile, pubescent, linear-oblong, half an inch long, curved, somewhat compressed contrary to the sutures, nearly 2-celled, with a deep dorsal furrow, the ventral suture prominent.—New Mexico to Sonora; in Western New Mexico, Loew (203).

Astragalus gracilis, Nutt. (Gen. ii, 100).—Perennial, somewhat appressed-pubescent, slender, erect or ascending, a foot high or more: leaflets 3 to 5 pairs, narrowly linear, half an inch long or less: flowers very small, white or purplish, in an elongated open long-peduncled spike: calyx-teeth very short: pods coriaceous, sessile, pubescent and rugose, 2 or 3 lines long, ovate-oblong and obcompressed, 1-celled, concave on the back, and the ventral suture prominent.—From Minnesota to Arkansas and the Rocky Mountains; at Kit Carson, Colo., Wolf (248).

Astragalus aboriginum, Richardson. (*Phaca aboriginum*, Hook. Fl. i, 143, t. 66.)—From Colorado and Northern Nevada to the Arctic Zone; South Park, Wolf (249).

Astragalus oroboides, Hornem., var. Americanus, Gray.—Allied to the last; more nearly glabrous: leaflets obtuse or retuse: flowers on longer

pedicels, in a loose elongated raceme, purple: calyx-teeth shorter than the tube: pod very shortly stipitate, pubescent, reflexed, half an inch long or less, oblong-ovate, nearly terete or slightly compressed.—From Colorado to Wyoming and the Saskatchewan; South Park, Wolf (233).

Astragalus alpinus, Linn.—From Maine to Washington Territory and northward, and south in the Rocky Mountains to Colorado; South Park, Wolf (211, 229, 244, 245, 246).

Astragalus lotiflorus, Hook. (Fl. i, 152).—Perennial, hoary with appressed silky hairs, very low and diffuse: leaflets 2 to 5 pairs, oblong to linear, a half to an inch long: flowers few, yellow, small, nearly sessile in a long-pedunculate or sessile spike: calyx-teeth at least as long as the tube, and often nearly equalling the petals: pods coriaceous, about an inch long, sessile, straight, pubescent, acuminate-oblong, obcompressed, 1-celled, with a more or less deep dorsal furrow, and the ventral suture somewhat prominent.—From Texas to Nebraska and northward; at Denver, Wolf (239).

Astragalus Missouriensis, Nutt. (Gen. ii, 99).—Perennial, canescent with closely appressed dense silky straight pubescence, low and shortly caulescent or nearly stemless: leaflets 4 to 9 pairs, oblong to rarely obovate, 2 to 4 lines long, acute or obtuse: spikes short, on peduncles equalling the leaves: flowers purple, rather large: calyx-teeth much shorter than the cylindrical appressed-silky tube: pods 8 to 12 lines long, thick-coriaceous, oblong and somewhat obcompressed, nearly straight, obtuse at base, pubescent and rugose, 1-celled, with the ventral suture prominent, and often more or less concave on the back.—A rather common species, from the Saskatchewan and Wyoming Territory to New Mexico; at Kit Carson, Colo., Wolf (240), and at Deer Spring, Ariz. (186).

Astragalus Shortianus, Nutt. (Torr. & Gray, Fl. i, 331). (*A. cyaneus*, Gray, Pl. Fendl 34.)—Like the preceding, but the leaves broader and usually obovate; the pubescence upon the calyx of coarse, somewhat entangled hairs, not appressed; the pod as in the last, but larger, longer (sometimes two inches long), and more curved.—Colorado to Wyoming and New Mexico; Clear Creek, Colo., Wolf (241), and N. Mexico, Rothrock (1112).

Astragalus Parryi, Gray (Am. Journ. Sci 2d ser. xxxiii, 410).—Similar in habit, but villous throughout with loose spreading hairs; stems decumbent: leaflets obovate to oblong, often retuse and usually small: calyx-teeth large and about equalling the tube: pods narrower, an inch long and curved, more compressed, and nearly 2-celled by the depression of the sutures.—Colorado to Northwestern Texas; Wolf (237), but the locality not given.

Astragalus iodanthus, Watson (Bot. King's Expl. 70).—Northern Nevada and Utah. Flowering specimens collected in Cañon de Chelli (212) (also by Dr. Coulter, on Hayden's Survey, in Clear Creek Cañon) are perhaps referable to this species, though the corolla is nearly white.

Astragalus Utahensis, Torr. & Gray (Pacif. R. Rep. ii, 120).—Utah to Nevada; near Salt Lake, 1872.

Astragalus lonchocarpus, Torr. (Pacif. R. Rep. iv, 80).—Perennial, erect, slender, puberulent or glabrate, a foot high or more: leaflets 4 pairs or fewer, often only a terminal inarticulated one, linear, about an inch long: flowers ochroleucous, 6 to 8 lines long, spreading in a loose long-pedunculate raceme: calyx-teeth short: pods membranous, linear, attenuate at each end and long-stipitate, an inch and a half long, straight, glabrous, reflexed, terete or obcompressed, 1-celled, the sutures usually somewhat impressed.—Colorado to New Mexico and Utah; Santa Fé (18).

Astragalus pectinatus, Dougl. (Hook. Fl. i, 143).—Perennial, puberulent or glabrate, erect and stout, a foot high or more: leaflets 5 to 8 pairs, not jointed upon the rhachis, narrowly linear, an inch or two long: flowers large, spreading in a loose pedunculate raceme, ochroleucous: pods thick-cartilaginous, somewhat pubescent, ovate or oblong, turgid, sessile, half an inch long, reflexed, 1-celled, with thick prominent sutures.—From the Saskatchewan to Colorado and Oregon; at Kit Carson, Colo., Wolf (234).

Astragalus Fendleri, Gray (Pl. Wright. ii, 44).—Perennial, puberulent, slender, erect or decumbent, a foot high or more: leaflets 7 to 12 pairs, oblong to linear, obtuse, about half an inch long: flowers purple, 4 or 5 lines long, spreading in loose long-pedunculate racemes: calyx-tube and teeth short: pods coriaceous, slightly pubescent or glabrate, broadly

linear, nearly an inch long, sessile or very nearly so, reflexed, usually somewhat compressed, 1-celled, with neither suture very prominent or impressed.—Colorado and New Mexico; at Apex, Wolf (226).

Astragalus Hallii, Gray (Proc. Am. Acad. vi, 224).—Distinguished from the last chiefly by the pods, which are glabrous, shortly stipitate, oblong, 9 lines long: flowers a little larger, violet, in short and denser racemes: leaflets often retuse.—Colorado to New Mexico; South Park, Wolf (228, 247).

Astragalus cyrtoides, Gray (Proc. Am. Acad. vi, 201).—Northern Nevada, where it was collected in 1871.

Astragalus multiflorus, Gray (Proc. Am. Acad. vi, 226).—In the mountains from New Mexico and Nevada to the Saskatchewan and Washington Territory; at Santa Fé, Rothrock (40), in the South Park, Wolf (207, 250), and in Nevada, 1871.

Astragalus tegetarius, Watson (Bot. King's Expl. 76, t. 13).—Colorado and Northern Nevada; South Park, Wolf (243).

Astragalus campestris, Gray (*l. c.* 229).—Wyoming to Utah and New Mexico; on the Blue River, Colorado, Wolf (218, 230).

Astragalus junceus, Gray (*l. c.* 230).—Wyoming to Southern Utah and Colorado; Denver, Wolf (235).

Oxytropis Lamberti, Pursh.—From the Saskatchewan to Texas and Arizona; at Oro City and Kit Carson, Colo., Wolf (220–224), and at Chiricahua Agency, Ariz. (528).

Oxytropis splendens, Dougl. (Hook. Fl. i, 127).—Similar to the last: pubescence more villous and spreading: leaflets many pairs, somewhat verticillate: spikes dense and very villous, the smaller flowers (4 to 6 lines long) scarcely exceeding the bracts: pods ovate, half an inch long.—From Northern New Mexico to British America; South Park, Wolf (225).

Oxytropis campestris, Linn., var. viscida, Watson (Bot. King's Expl. 77). (*O. viscida*, Nutt.)—More or less viscid with resinous dots.—Wyoming to Northern Nevada and Colorado; South Park, Wolf (252).

Oxytropis multiceps, Nutt. (Torr. & Gray, Fl. i, 341).—Alpine, dwarf, acaulescent, an inch or two high, canescently appressed-silky, the hairs spreading upon the peduncles and inflorescence: leaflets 2 or 3 pairs,

linear-oblong, 1 to 3 lines long, acute: peduncles as long as the leaves, about 2-flowered: calyx becoming inflated and globose in fruit; teeth not equalling the tube: corolla purple, half an inch long: pods included in the calyx, ovate, partially 2-celled by the intrusion of the ventral suture, shortly stipitate, very pubescent.—Colorado; at Gold Hill, Wolf (213).

Oxytropis deflexa, DC. (Prodr. ii, 280).—Caulescent, erect, often a foot high or more, silky-villous: leaflets 10 to 15 pairs, oblong-ovate or lanceolate, acute, half an inch long: flowers small, purple, in at length elongated spikes on very long peduncles: calyx-teeth as long as the tube and equalling the corolla: pod coriaceous, linear-oblong, 6–8 lines long, reflexed, pubescent, partially 2-celled by the intruded ventral suture.—In the Rocky Mountains from the Saskatchewan to New Mexico; South Park, Wolf (217).

Glycyrrhiza lepidota, Nutt.—From Washington Territory to Hudson Bay and southward to Nevada, New Mexico, and Arkansas; at Covero, N. Mex., Rothrock (106), in the valley of the Upper Arkansas, Colorado, Wolf (190), also in Nevada and Utah, 1871 and 1872.

Psoralea lanceolata, Pursh (Flora, 475).—Frequent from Washington Territory to Northern Arizona, and eastward to Nebraska; at Denver, Wolf (181).

Psoralea floribunda, Nutt. (Torr. & Gray, Fl. i, 300).—Resembling the last, more or less canescent, with short white appressed hairs: petioles mostly very short: peduncles exceeding the leaves, and flowers on short slender pedicels: calyx-teeth acute.—From Texas to Western Arizona; Neutria, N. Mex., Rothrock (145), and in Eastern Arizona, Loew (858).

Parryella* filifolia, Torr. & Gray.—Puberulent or nearly glabrous, diffusely branched, apparently a foot high or more: leaves 2 or 3 inches long; leaflets 10 to 15 pairs, linear-revolute, 3 or 4 lines long, with acute glandular stipules: spikes slender; bracts very small, acute: calyx nearly

*Parryella, Torr. & Gray, Proc. Am. Acad. vii, 397.—Calyx obconical, persistent; teeth short, nearly equal. Petals wanting. Stamens 10, distinct, inserted on the base of the calyx; anthers uniform. Ovary 2-ovuled. Pod indehiscent, obliquely obovate, exserted, 1-seeded, glandular-dotted.—A low shrub, with numerous slender branches, sparingly glandular-punctate; leaves unequally pinnate, with glandular stipules; leaflets numerous, linear, stipellate; flowers spicate on terminal peduncles.

sessile, a line and a half long: filaments and pubescent style slightly exserted: pod 3 or 4 lines long, attenuate at base.—New Mexico and Arizona, rarely collected; near Santa Fé, Rothrock (91). PLATE II.*

AMORPHA FRUTICOSA, Linn.—In its various forms from Winnipeg Valley to Texas and New Mexico and eastward to the Atlantic; at Willow Spring, Ariz., at 7,200 feet altitude, Rothrock (244), apparently the typical broad-leaved form, in flower, and resembling specimens collected at San Diego, Cal., by Palmer (65), in 1875. Only the fruit will determine positively whether it be not *A. Californica*, Nutt., which has a shorter and broader pod than the Eastern species, and usually more slender and acute calyx-teeth.

PETALOSTEMON CANDIDUS, Michx.—From the Saskatchewan to Arizona and eastward to Michigan and the Mississippi; at Willow Spring, Ariz., Rothrock (248), and Cosino Caves, Loew (192).

PETALOSTEMON TENUIFOLIUS, Gray (Proc. Am. Acad. xi, 73).—Perennial, branching, pubescent or glabrate, low: leaflets 3 to 5, linear or revolute-filiform, 3 to 6 lines long, about equalling the petiole, sparingly glandular: spikes ovate to cylindrical, dense, rather long-pedunculate; bracts ovate, rather abruptly attenuate into a long awn, densely silky-villous as well as the calyx: calyx-teeth lanceolate, attenuate, equalling the tube: petals rose-colored; standard round-cordate, hooded.—Western Arkansas to New Mexico; Arizona, Rothrock (81). PLATE II.†

DALEA ALOPECUROIDES, Willd.—From Sonora to Colorado and eastward to Texas and Southern Illinois; Arizona or New Mexico, Loew (274).

DALEA ALBIFLORA, Gray (Pl. Wright. ii, 38).—Perennial, herbaceous, erect, more or less hoary-pubescent, a foot high or more: leaflets small, 10 to 15 pairs, narrowly oblong, obtuse, smoother above, 2 or 3 lines long: spikes cylindrical, dense and densely white-silky; bracts subulate-setaceous, exceeding the calyx: teeth of the calyx subulate, a little shorter than the tube: petals white.—New Mexico to Sonora; Camp Bowie, Ariz. (502).

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* A. Branch; natural size. Fig. 1. Flower. Fig. 2. A vertical section through flower. Fig. 3. Stamineal tube laid open. Fig. 4. Mature legume. Fig. 5. A vertical section through the same, showing the seed and embryo. All except the branch enlarged about five diameters.

† B. A branch somewhat reduced. Fig. 6. A bract from beneath the flower. Fig. 7. A flower seen from the side. Fig. 8. A flower seen from above, with four petals on the stamineal column, and the fifth on the calyx. Fig. 9. A section through the pod, with the seed in position. All except the branch enlarged about five diameters.

Dalea Jamesii, Torr. & Gray (Fl. i, 308).—Densely appressed-silky, the somewhat decumbent stems 2 to 4 inches high from a branching woody base: leaflets 3, oblanceolate or oblong, half an inch long, equalling the petioles: spikes sessile, ovate to oblong, rather dense, very villous with long silky hairs; bracts lanceolate, acuminate, about equalling the long plumose calyx-teeth, which much exceed the tube: petals yellowish or rose-colored, 5 lines long, scarcely exceeding the calyx.—New Mexico; western part of the Territory, Loew (189), locality not given.

Dalea Wislizeni, Gray (Pl. Fendl. 32).—Shrubby, with slender virgate branches, pubescent, a foot high or more: leaflets 7 to 9 pairs, oblong, obtuse, smoother above, 2 lines long or less: spikes short-ovate or oblong, dense, long-pedunculate, silky-villous; bracts lanceolate, long-acuminate, equalling the calyx: teeth of the calyx setaceous, plumose, a little longer than the tube, with a narrow tooth on each side: petals rose-colored, 4 or 5 lines long, twice longer than the calyx, with solitary glands near the top.—New Mexico to Sonora; Southern Arizona, Rothrock (594).

Dalea formosa, Torrey (Emory's Rept. 138, t. 1).—A low shrub, 1 to 3 feet high, with spreading flexuous branches, glabrous or nearly so: leaflets 3 to 5 pairs, cuneate-oblong, rarely 2 lines long, often very small and revolute: flowers few and spreading, in short spikes; bracts caducous: calyx very silky-villous, the setaceous plumose teeth longer than the tube and nearly equalling the corolla: petals deep rose-color, very unequal, the keel half an inch long.—New Mexico and Arizona; Camp Bowie, Rothrock (450).

Dalea Fremonti, Torrey (Gray, Pl. Thurb. 316).—In Southern Nevada, 1871; it has also been found in Southern Utah.

Hedysarum Mackenzii, Richardson (Torr. & Gray, Fl. i, 357).—In the Rocky Mountains of British America and southward to Wyoming and Utah; in the Wahsatch, 1871.

Zornia* diphylla, Persoon. (*Z. reticulata*, Smith.)—Slender, erect or

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*Zornia, Gmelin.—Calyx membranaceous, the two upper lobes connate, the lateral ones much smaller. Standard orbicular. Stamens united into a closed tube; alternate anthers shorter and versatile. Style filiform. Stigma terminal. Pod compressed, 2–5-jointed, the indehiscent joints rounded, usually hispid.—Herbs, mostly annual, with palmately 2–4-foliolate leaves, and foliaceous stipules; flowers yellow, solitary, sessile between a pair of large foliaceous stipular bracts, forming an interrupted spike.—Benth. & Hook., Gen. Pl. i, 518.

decumbent, a span high, puberulent and somewhat villous or glabrous: leaflets 2, ovate to linear, a half to an inch long, mostly acute and ciliate; stipules narrow, auricled downward at base and peltately attached, as also the floral bracts, which are closely appressed, ovate to lanceolate, 4 to 6 lines long, and nearly including the flower: pod small, included in the bracts or a little exserted.—A variable species, ranging from Arizona and New Mexico to Brazil, and also in the East and West Indies; Sanoita Valley, Ariz., Rothrock (620).

Desmodium cinerascens, Gray (Pl. Wright. ii, 48).—Perennial, decumbent or procumbent, cinereous with soft appressed hairs, the rather stout straight stems 2 to 4 feet long: leaflets elliptic-oblong, obtuse at each end, an inch or two long, exceeding the petiole, conspicuously marked beneath by the white-silky veins: racemes paniculate, many-flowered: flowers purple, 3 or 4 lines long, on shorter pedicels: pods 5–7-jointed, nearly equally constricted on both edges, puberulent; joints 2 or 3 lines long.—Arizona to Northern Mexico; Sanoita Valley, Ariz., Rothrock (660).

Desmodium Neo-Mexicanum, Gray (Pl. Wright. i, 53). (*D. exiguum*, Gray, *l. c.* ii, 46.)—Annual, very slender, erect, a foot or two high or more, sometimes procumbent, pubescent with very short spreading and somewhat glandular hairs, paniculately branched: leaflets 3, linear (or the lowermost ovate and shorter), an inch or two long or more, thin and reticulated, the narrow petioles an inch long or less: flowers minute (about a line long), on very slender, elongated pedicels, purple: pods 1–5-jointed, puberulent; joints rounded, reticulated, a line and a half long, the margins often undulate.—Var. Bigelovii (*D. Bigelovii*, Gray, *l. c.* ii, 47). Leaves somewhat broader near the base.—From New Mexico to Arizona and Northern Mexico; in Central Arizona, Loew, 1873, also in Sanoita Valley, Rothrock (632, 663), the latter number referable to the variety.

Desmodium batocaulon, Gray (Pl. Wright. ii, 47).—Stem elongated, procumbent, pubescent and adhesive by hooked hairs: leaflets 3, oblong-lanceolate, 1 to 2½ inches long, obtuse or acutish, rounded at base, somewhat pubescent with straight hairs, which are spreading upon the petiole: flowers purple, in loose elongated racemes, 3 to 6 lines long, on slender pedicels nearly as long; bracts broadly ovate, acuminate, 2 lines long,

caducous: pods shortly stipitate, 5–7-jointed; joints triangular-rounded, nearly smooth and glabrous, 1½ to 2½ lines long.—Southeastern Arizona, previously collected only by Mr. Wright in the valley of the San Pedro; at Rocky Cañon, Camp Grant, and Chiricahua Agency, Rothrock (290, 366, 531). It seems to differ only in its smoother pods from *D. Sonoræ*, Gray, *l. c.*, which is referred by Bentham to *D. uncinatum*, DC., of Mexico and southward. The latter has usually much larger, conspicuous bracts, broader leaves, and more densely tenacious-pubescent pods.

Vicia Americana, Muhl., var. linearis, Watson (Proc. Am. Acad. xi, 134). (*Lathyrus linearis*, Nutt.)—Leaflets linear.—A very common western form; San Francisco Mountains, 1872, and at Willow Spring, Ariz., Rothrock (224 in part), also at Denver, Colo., Wolf (185). Specimens of nearly the typical form were collected near Denver, Wolf (186), and in Nevada and Utah, 1871 and 1872.

Vicia pulchella, H. B. K. (Nov. Gen. vi, 499, t. 583).—Tall and very slender, sparingly silky-pubescent: leaflets linear, obtuse or acute, mucronate, a half to an inch long; stipules narrow: flowers small, numerous, usually crowded in long-peduncled racemes, equalling the leaves, pale purple or ochroleucous, 2 or 3 lines long, reflexed: pods linear-oblong, an inch long, nearly sessile, puberulent, 6–8-seeded.—From Western Texas to Arizona and southward; Mount Graham, and Willow Spring, Ariz., Rothrock (211, 434, 1006, 1009).

Lathyrus paluster, Linn.—The prevalent form has the leaves very narrowly linear.—Collected in Utah in 1872, at Clear Creek, Colo., Wolf (187), at Big Dry Fork, Ariz., Loew (204), at Rocky Cañon and Willow Spring, Ariz., Rothrock (286, 224 in part), and also at Fort Wingate, N. Mex., Rothrock (142).—The broader-leaved var. myrtifolius, Gray, appears to have been collected in the Wahsatch in 1872, referred in the published list to *L. venosus*.

Lathyrus polymorphus, Nutt. (Gen. ii, 96).—Perennial, erect, a foot or two high, stout and scarcely climbing, finely pubescent or glabrous, glaucous: leaflets 3 to 6 pairs, thick and strongly nerved, narrowly oblong, acute at each end, an inch or two long; stipules narrow, acuminate: peduncles equalling the leaves, 2–6-flowered: flowers purple, very large, 9

to 15 lines long: pod 2 inches long, upon a stipe as long as the calyx, 3 or 4 lines broad: seed with a very narrow funiculus and short hilum.—From Northern Colorado to New Mexico and Central Arizona; at Santa Fé, Rothrock (3, 9), and in Arizona, 1872.

Cologania* longifolia, Gray (Pl. Wright. ii, 35).—Perennial, climbing, 2 or 3 feet high, pubescent throughout with short appressed hairs or nearly glabrous: leaflets 3, rarely 4 or 5, linear to linear-oblong, 1 to 4 inches long, about equalling the petiole, obtuse, mucronate, reticulated beneath, glabrous above: flowers solitary in the axils, on short pedicels, purple, 9 lines long, twice longer than the calyx: pods straight, narrowly linear, an inch and a half long, pubescent, 10–14-seeded.—New Mexico and Arizona; on the Mogollon Mesa, Loew (205), and at Willow Spring, Ariz., Rothrock (214).

Galactia tephrodes, Gray (Pl. Wright. ii, 34).—Perennial, low and erect or twining, 2 or 3 feet high, canescent with soft appressed pubescence: leaflets 3, oblong to linear-oblong, obtuse at each end, mucronate, an inch long, smoother above, exceeding the petioles: flowers scattered in usually elongated racemes, half an inch long, twice longer than the calyx: pods somewhat curved, linear, nearly two inches long, appressed-pubescent.—New Mexico and Arizona; near Camp Bowie, Rothrock (487).

Phaseolus Wrightii, Gray (Pl. Wright. i, 43).—Stems prostrate or twining, slender, from a perennial woody fusiform root; sparingly rough-pubescent: leaflets 1 or 2 inches in diameter, hastately lobed, the lateral lobes quadrangular, often repand at the end, the terminal one oblong, obtuse or acute, mucronate: peduncles exceeding the leaves, few-flowered: flowers purple, 3 to 8 lines long, exceeding the pedicels: pods an inch long, reflexed, compressed, falcate, pubescent, 6–8-seeded.—New Mexico and Arizona; on Mount Graham, at 9,250 feet altitude, and at Chiricahua Agency, Rothrock (417, 535), and in woods on Mogollon Mesa, Loew (206).

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*Cologania, Kunth.—Calyx tubular; upper teeth connate, the lower one longest. Standard obovate, with broad claw and reflexed sides; keel shorter, slightly incurved. Stamens diadelphous; anthers uniform. Style naked: stigma capitate. Pod linear, straight, compressed, stipitate, 2-valved, somewhat partitioned between the several seeds.—Twining herbs, with 3- (rarely 1–5-) foliolate leaves, rather large axillary purple or rose-colored flowers, and persistent narrow bracts and bractlets.—Benth. & Hook. Gen. Pl. i, 529.

Phaseolus retusus, Benth. (Pl. Hartw. 11).—Stems stout, trailing, 6 to 8 feet long, from a very large perennial root, pubescent with short spreading hairs: leaflets rhomboid-ovate, 2 or 3 inches long, thick, obtuse or acutish, occasionally retuse, mucronate, strongly veined: racemes elongated and long-pedunculate, rather many-flowered: flowers purple, half an inch long, on short pedicels: pods broadly oblong, slightly falcate, 2 inches long, compressed, 4–6-seeded.—From Western Texas to Arizona; at Chiricahua Agency, Ariz., Rothrock (522).

Rhynchosia Texana, Torr. & Gray (Fl. i, 687).—Diffuse, slender, somewhat twining, a foot or two high, minutely pubescent throughout: leaflets ovate to linear-oblong, an inch long or usually less, obtuse at each end, mucronulate, often resinous-dotted beneath: flowers 3 lines long, on short pedicels, solitary in the axis, or rarely 2 to 5 together upon a very short peduncle: pods oblong, narrowed to the base, about 8 lines long.—From Texas to Arizona; at Sulphur Springs, Ariz., Rothrock (545).

Hoffmanseggia* Jamesii, Torr. & Gray (Fl. i, 393).—Finely pubescent; stems clustered, herbaceous, from a stout woody root, erect or decumbent, often a foot high or more: pinnæ 1 to 3 pairs; leaflets 4 to 7 pairs, oblong, obtuse, 2 or 3 lines long, glandular-dotted beneath: stipules and bracts subulate-setaceous: raceme open: sepals oblong, acute, 3 or 4 lines long, equalling the corolla, glandular-dotted, as also the upper petals: claws of the petals short and nearly naked: pods an inch long, nearly half as broad, falcate, dotted and pubescent, with plumose hairs on the edges, 2–4-seeded.—From Colorado and Texas to New Mexico; at El Rito and elsewhere in New Mexico, Rothrock (95, 1010).

Hoffmanseggia stricta, Benth. (Gray, Pl. Wright. i, 56).—Finely pubescent, somewhat glandular above, not glandular-dotted; the clustered stems erect, from a perennial root, a half to a foot high: pinnæ 4 to 6 pairs; leaflets 6 to 8 pairs, oblong, obtuse, a line or two long; stipules and bracts

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* Hoffmanseggia, Cavanilles.—Calyx-tube very short, the 5 oblong or lanceolate, nearly equal segments slightly imbricate or valvate. Petals oblong or ovate, slightly unequal, imbricated, the upper one included and usually dissimilar. Stamens 10, distinct; filaments usually glandular at base; anthers uniform, versatile, dehiscent longitudinally. Style often incurved-clavate; stigma terminal. Pod flat, thin, 2-valved, linear or ovate, several-seeded.—Perennial herbs or low shrubs, mostly glandular, with bipinnate leaves and small leaflets, yellow racemose flowers, and deciduous bracts.—Benth. & Hook. Gen. Pl. i, 567.

broadly ovate: racemes open: sepals oblong, obtuse, more or less pubescent, 3 lines long, a half shorter than the corolla: upper petal veined with purple, the claws and outer filaments densely stipitate-glandular: pods linear-oblong, an inch long or more, nearly straight, puberulent and somewhat stipitate-glandular, 6–12-seeded.—From New Mexico and Arizona to Northern Mexico; at Camp Goodwin, Ariz., Rothrock (351).

HOFFMANSEGGIA DREPANOCARPA, Gray (Pl. Wright. i, 58).—Puberulent, not glandular nor glandular-dotted, the stems scarcely 6 inches high. from a perennial root: pinnæ 2 to 5 pairs; leaflets 4 to 10 pairs, oblong, obtuse, 2 or 3 lines long; stipules and bracts broadly ovate: racemes open: sepals oblong, acute, 2 or 3 lines long, about equalling the obovate sessile naked petals: pods linear-oblong, curved, obtuse, an inch long or more, puberulent, 6–10-seeded.—Colorado to New Mexico and Arizona; at Camp Bowie, Ariz., Rothrock (1008).

PARKINSONIA* MICROPHYLLA, Torrey (Bot. Mex. Bound. 59).—A shrub 5 to 10 feet high, with smooth light-green bark, much branched, the straight rigid branchlets spinulose; the younger branches and inflorescence somewhat puberulent: common petioles very short or none, rarely spinescent: leaflets 4 to 6 pairs, on a terete rhachis, broadly oblong or rounded, obtuse or acutish, not narrowed at the oblique base, glaucous, 2 lines long or less: racemes very short, axillary and sessile; pedicels evidently jointed a little below the flower: calyx valvate: petals 3 or 4 lines long, deep straw-color, the upper one white: anthers orange, exserted: ovary appressed-silky: pod 2 or 3 inches long, attenuate at each end, 1–3-seeded, contracted between the seeds.—Southern Arizona, from the Colorado eastward; collected in 1871, the locality not given.

CASSIA BAUHINIOIDES, Gray (Pl. Lindh. ii, 180).—Perennial, herbaceous, a span high, stout, cinereous with a usually dense, more or less appressed pubescence: leaflets a single pair, oblique, ovate-oblong, obtuse, 8 to 15

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* PARKINSONIA, Linn.—Calyx 5-parted, with a long-turbinate base jointed on the pedicel; divisions mostly valvate. Petals with claws, the upper included and broadest, somewhat cordate; the claw pubescent and nectariferous. Stamens 10, distinct; filaments pilose at base, the upper one gibbous; anthers versatile, dehiscent longitudinally. Style filiform, acute. Pod thin-coriaceous, 2-valved, linear to linear-oblong, compressed, usually more or less torulose. Seeds albuminous.—Trees or shrubs, often spinose; leaves bipinnate, the common petiole short (often spinescent or none), with 1 or 2 pairs of pinnæ; flowers yellow, on slender pedicels, in short loose racemes.—WATSON, Flora Calif. i, 162.

lines long; a gland between the leaflets: stipules and bracts setaceous: peduncles axillary, 1–2-flowered, a little exceeding the petioles: sepals oblong-ovate: petals veined, 4 to 6 lines long: stamens 7: pods hispid, an inch long or more, nearly straight, compressed, 2-valved, many-seeded.—Western Texas to Arizona; at Camp Bowie and Cottonwood, Ariz., Rothrock (1007, 360).

Cassia Covesii, Gray (Proc. Am. Acad. vii, 399).—Resembling the last, but more canescent, with 2 or 3 pairs of leaflets, and the 3–7-flowered peduncles exceeding the leaves: pods appressed-pubescent.—From Arizona to Lower California; collected in Northern Arizona in 1871, locality not given.

Cassia armata, Watson (Proc. Am. Acad. xi, 136).—Perennial, herbaceous, 3 feet high, minutely puberulent, light green: leaflets 2 or 3 pairs, distant, upon an elongated rigid flattened spinulose rhachis, thick, round-ovate, a line or two in diameter, acutish, the margin revolute; stipules and glands wanting: flowers yellow, 2 or 3 lines long, in a short terminal raceme: stamens 7: ovary slightly pubescent; pod glabrate, shortly stipitate, linear, compressed, somewhat curved, many-seeded.—Known only from imperfect specimens collected in Western Arizona in 1871, and also previously by Dr. Cooper in the California Desert.

Cassia Wrightii, Gray (Pl. Wright. ii, 50).—Perennial, woody at base, with numerous slender ascending stems, glabrous, a foot high: leaflets 4 to 6 pairs, narrowly oblong, obtuse, 2 or 3 lines long, thin, the midvein nearer the upper edge; stipules subulate, nerved; a stipitate gland below the lowest leaflets: pedicels solitary, axillary, exceeding the leaves, spreading: sepals membranaceous, unequal, 4 or 5 lines long: petals clear yellow, a half longer: pods linear, flat, shortly stipitate, an inch long or more, 6–8-seeded.—New Mexico and Arizona; at Camp Crittenden, Rothrock (683).

Cassia nictitans, Linn.—From Arizona to the Atlantic and southward; in Sanoita Valley, Rothrock (629).

Prosopis juliflora, DC. (Benth. Rev. Mim. 377). (*P. glandulosa*, Torr.)—Shrub or tree, becoming 30 or 40 feet high, glabrous or puberulent, often with stout axillary spines: leaflets 6 to 30 pairs, oblong to linear,

half an inch long or often more: spikes cylindrical, usually dense, shortly pedunculate, 2 to 4 inches long, 1–3-fruited: flowers a line long: pods 4 to 6 inches long or more, stipitate, straight or curved, narrow, flat, at length thickened and pulpy within.—From Texas to Southern California and southward to Chili and Brazil; at Ash Meadows, Southern Nevada, in 1871, and in the Gila Valley, Rothrock (320).

PROSOPIS PUBESCENS, Benth. (Lond. Journ. Bot. v, 82). (*Strombocarpus pubescens*, Gray.)—New Mexico to Southern California; at Ash Meadows, Southern Nevada, 1872.

DESMANTHUS JAMESII, Torr. & Gray (Fl. i, 402).—Slightly puberulent, erect or decumbent, a foot high or less: pinnæ 3 to 6 pairs, the lowest approximate to the stem; leaflets 8 to 13 pairs, oblong, acutish, not veined, 2 lines long or less; gland large, oblong; stipules very small: heads large, 3 or 4 lines in diameter without the stamens, on peduncles an inch in length or often much less: pods linear, straight or nearly so, 3 or 4 inches long, obtuse or acute, 12–16-seeded.—Var. (?) FENDLERI, with smaller fewer-flowered heads, and the thick pods 2 inches long or more, and usually 8–12-seeded.—From Arkansas and New Mexico westward; at Cooley's Ranch and Camp Apache, Ariz., Loew (1116) and Rothrock (255), and the variety at Rocky Cañon, Ariz., Rothrock (291), and Cañon del Diablo (192); the last referred doubtfully in the catalogue to *D. velutinus*. This variety is identical with 179 Fendler and 169 Wright, considered by Dr. Gray (Pl. Wright. i, 63) to be a form of *D. Jamesii*, but placed rather under *D. reticulatus* by Bentham (Rev. Mim.). The earlier reference appears to be the better.

MIMOSA* BIUNCIFERA, Benth (Pl. Hartw. 12).—A shrub 6 feet high, puberulent, with a pair of short stout recurved prickles below each leaf: pinnæ 4 to 7 pairs; leaflets 10 to 15 pairs, narrowly oblong, obtuse, a line long or less; stipules setaceous; occasionally very small prickles upon the

* MIMOSA, Linn.—Flowers perfect or polygamous. Calyx mostly minute, rarely campanulate, shortly toothed. Petals connate, valvate. Stamens as many or twice as many as the petals, distinct, exserted; pollen-grains numerous. Style filiform. Pod oblong or linear, membranaceous or coriaceous, compressed, the 2 valves at length separating from the persistent margin.—Herbs or shrubs, often armed; leaves bipinnate, the petioles without glands and the pinnæ stipellate; flowers small, sessile in globose or cylindrical spikes, on solitary or fascicled axillary peduncles, or the uppermost racemose.—BENTH. & HOOK. Gen. Pl. i, 593.

rhachis: peduncles solitary or in pairs, a little shorter than the leaves: flowers capitate, minutely pubescent, purplish: calyx campanulate, half the length of the petals: stamens 8 or 10: pods sessile, linear, falcate or nearly annular, an inch long, flat, glabrous, continuous, the margins usually sinuous and armed with a few short prickles or naked.—New Mexico to Arizona and southward; collected in Arizona in 1872, and at Rocky Cañon, Rothrock (272).

Mimosa borealis, Gray (Pl. Fendl. 39).—An erect shrub, glabrous throughout, armed with scattered very stout recurved prickles: pinnæ 1 or 2 pairs; leaflets 3 to 5 pairs, oblong, 1 to 1½ lines long: peduncles solitary or in pairs, half an inch long or more, exceeding the leaves: flowers capitate, purplish: calyx very shortly campanulate: corolla deeply cleft: stamens 8 or 10: pods stipitate, an inch or two long, 3 or 4 lines broad, glaucous, continuous or at length separating into 3 or 4 joints, the sinuous margins armed with stout prickles.—From Western Texas to Arizona, where it was collected in 1872, but locality not given.

Mimosa dysocarpa, Benth. (Gray, Pl. Wright. i, 62).—Diffusely branched and apparently procumbent, pubescent throughout, both the stem and petioles armed with numerous scattered flattened somewhat recurved prickles: pinnæ 6 to 10 pairs; leaflets 8 to 10 pairs, oblong, acutish, silky-pubescent both sides, 1½ to 2 lines long, the nerve near the margin: spikes axillary, solitary or in pairs, oblong and rather loosely flowered, shorter than the leaves and shortly pedunculate: calyx campanulate, half the length of the purplish deeply cleft corolla: stamens 8 or 10: pods stipitate, linear, flat, 1½ to 2 inches long, very densely pubescent, at length separating into 4 to 6 joints, the thick margin often armed.—From Western Texas to Arizona, and probably southward; at the Chiricahua Agency, Rothrock (511).

Acacia* Greggii, Gray (Pl. Wright. i, 65).—A small tree 10 to 20 feet high, pubescent or glabrous, unarmed or with scattered stout recurved prickles: pinnæ 2 or 3 pairs, on a slender petiole; leaflets 4 or 5 pairs,

*Acacia, Willd.—Flowers perfect or polygamous. Calyx usually campanulate, and 4–5-toothed. Petals more or less united. Stamens numerous, exserted, distinct or nearly so; anthers small: pollen-grains united into 2 to 4 masses in each cell. Style filiform. Pod 2-valved or indehiscent, compressed and membranaceous, or more or less thickened and terete, many-seeded. Seeds compressed.—Shrubs or trees, often spinose or prickly; leaves bipinnate, with small leaflets; stipules very small or spinescent; flowers small, yellowish, in globose or cylindrical spikes on axillary peduncles.

oblong or oblong-obovate, 2 or 3 lines long, rounded or truncate above, narrower at base, rather thick and with 2 or 3 straight nerves: flowers in cylindrical spikes an inch or two long, the peduncles equalling or exceeding the leaves: pods thin-coriaceous, flat, 3 or 4 inches long by 5 to 7 lines broad, shortly stipitate, acute, curved, glabrous and reticulated, more or less constricted between the seeds: seeds half an inch long.—From Western Texas to Southern California; collected in Western Arizona, 1872.

ACACIA CONSTRICTA, Benth. (Gray, Pl. Wright. i, 66).—A shrub 5 to 8 feet high, puberulent or nearly glabrous, somewhat glutinous, more or less armed with nearly straight slender stipular spines, 3 or 4 lines long or less: pinnæ 2 to 7 pairs; leaflets 6 to 10 pairs, narrowly oblong, obtuse, 1 to 1½ lines long: peduncles solitary, shorter than the leaves, bracteate in the middle: head globose, 3 or 4 lines in diameter in flower: pods stipitate, narrowly linear, 2 to 4 inches long, curved, glabrous, flat, contracted between the distant seeds.—From Western Texas to Arizona and southward; collected at Cottonwood, Cienega, and in the Gila Valley, Ariz, Rothrock (322, 553).

ACACIA FILICINA, Willd. (*A. hirta*, Nutt. *A. Texensis*, Torr. & Gray. *A. cuspidata*, Schlecht. *A. Hartwegi*, Benth.; &c.)—A shrub 1 to 5 feet high, erect, pilose-hirsute or glabrate, unarmed: pinnæ 4 to 20 pairs, a half to two inches long; leaflets 10 to 60 pairs, linear or linear-oblong, acute or obtusish, 1½ to 3 lines long: heads globose, rather few-flowered, on slender peduncles a half to an inch long, mostly paniculate: flowers pedicellate: calyx very short: corolla greenish, a line long: stamens pale yellow, rarely pinkish: pods stipitate, 1 to 3 inches long, 3 to 5 lines broad, flat, straight, with thin valves and nerve-like margins, 3–8-seeded.—Arkansas to Arizona and southward to Central America; in Western Arizona, 1872, and at Rocky Cañon, Rothrock (300).

CALLIANDRA* HUMILIS, Benth. (Lond. Journ. Bot. v, 103). (*C. herbacea*, Engelm. in Gray, Pl. Fendl. 39.)—A span high or less, nearly herbaceous, ascending from an elongated woody root, pilose or sometimes

* CALLIANDRA, Benth.—Flowers polygamous. Calyx campanulate, 5–6-toothed or cleft, valvate. Petals united to the middle, valvate. Stamens usually numerous, connate below into a tube, long-exserted, red or white; anthers minute; pollen in 2 or 4 masses in each cell. Style filiform. Pod linear, straight or nearly so, narrowed at base, compressed, the valves separating elastically from the apex downward.—Shrubby or woody only at base, mostly unarmed; leaves bipinnate with small leaflets (in our species); flowers in globose heads on axillary simple or racemose peduncles.—BENTH. & HOOK. Gen. Pl. i, 596.

glabrate: pinnæ 3 to 6 pairs, the lowest remote from the stem; leaflets 8 to 25 pairs, oblong-linear, acutish, a line or two long, strongly veined: peduncles solitary, a half to an inch long: corolla purplish, about 3 lines long, at least twice longer than the calyx: stamens about 30: pods coriaceous, stipitate, somewhat hairy, 2 or 3 inches long by 3 lines broad, with very thick margins, 4–6-seeded.—Western Texas to Arizona and Mexico; Cañon del Diablo, Arizona, Loew.

CALLIANDRA ERIOPHYLLA, Benth. (*l. c.* iii, 105). (*C. Chamædrys*, Engelm. *l. c.*)—Shrubby, a foot high or less, appressed-pubescent and more or less villous: pinnæ 2 to 7 pairs, the lower not distant from the stem, about half an inch long; leaflets about 10 pairs, oblong, obtuse or acutish, 1 to 2½ lines long, villous beneath or nearly glabrous: peduncles slender, solitary or in pairs, a half to an inch long: flowers purplish, more or less hairy: calyx short: corolla 2½ lines long: stamens very numerous: pods as in the last, 2 to 4 inches long, pubescent, 6–10-seeded.—From Western Texas to Arizona and Mexico; at Camp Grant and Cottonwood, Ariz., Rothrock (352, 455).

ROSACEÆ.

PRUNUS DEMISSA, Walp.—My specimens were obtained doubtless from near where Fendler secured his. In some of its forms too close to *P. serotina.* No. 400 of the Colorado collection I have doubtfully assigned to this species.—Nevada and Utah.

NEILLIA* PAUCIFLORA, Benth. & Hook. (*Spiræa opulifolia, γ. pauciflora,* T. & G. Fl. 1, p. 414.)—Differing from *Neillia opulifolia* (Benth. & Hook.) in smaller leaves, fewer flowers (5–10) to the corymb, and having usually less than four hairy carpels, and one to two mature ovaries. Still, however, it is quite variable. 402, from Mount Graham, has large leaves, and 53, from Santa Fé, has as high as 14 flowers to the corymb.

SPIRÆA MILLEFOLIUM, Torr. (Pacific R. R. Report, 4, 83, t. 5).—"Woolly-tomentose; leaves oblong-lanceolate in outline, pinnate, with many pairs of small leaflets, pinnæ pinnatisect, or parted, oblong-linear, densely crowded with the very minute oblong divisions; flowers racemose-panicu-

* NEILLIA, Don, differs from *Spiræa* in inflated carpels, harder testa to the seeds, and copious albumen.

late. Ovaries 5, distinct, at first woolly; styles filiform. Mature carpels nearly glabrous; ovules 8–10, pendulous from the upper part of the ovary" (Torr. *l. c.*).—Southern Nevada. Dr. Torrey remarks, 'that the leaflets are almost as small and crowded as in *Chamæbatia*'; from this, however, it may at any stage be distinguished by the *pleasant* balsamic odor of the latter. Loew, Arizona (188).

Spiræa discolor, Pursh, var. dumosa, Watson, Nutt. (*S. ariæfolia*, Smith, var. *discolor*, T. & G.)—Mount Graham, Arizona, at 9,250 feet altitude (396), and Colorado (401).

Spiræa cæspitosa, Nutt.—Utah.

Rubus Neo-Mexicanus, Gray (Pl. Wright. 2, p. 55).—Shrub 5–10° high, unarmed, smooth and glandless; bark peeling away from the older branches, as in *R. deliciosus;* leaves round-cordate, longer than the petioles, 3-lobed, irregularly deeply and doubly serrate; stipules lance-ovate, nearly $\frac{1}{2}'$ long, these with leaves and young shoots all canescently pubescent; calyx-lobes tipped with a conspicuous 3-ribbed appendage; flowers white, $1\frac{1}{2}'$ in diameter; carpels red, densely agglomerated into a head; seeds conspicuously rugose-reticulate. As already remarked by Dr. Gray, it is very close to *deliciosus*, Torr.—Mount Graham, Ariz., 9,250 feet altitude (397).

Rubus deliciosus, Torr.—Leaves uniform-orbicular, rugose, 1–2′ in diameter, smaller somewhat than in preceding species; flowers white, 2′ in diameter; tips to the petals $\frac{1}{4}$–$\frac{1}{2}'$ long, 1–2″ wide, indistinctly ribbed.—Colorado (380).

Rubus Nutkanus, Mocino.—Utah.

Rubus strigosus, Michx.—Utah; Mosquito Pass, Colorado (388).

Purshia tridentata, DC.—Nevada and Utah.

Cerocarpus parvifolius, Nutt.—Colorado, at middle altitudes, along the valley of the Upper Arkansas (69, 980); Arizona.

Cerocarpus ledifolius, Nutt. "Mountain mahogany."—Nevada and Utah.

Cowania Mexicana, Don.—Sanoita Valley, Southern Arizona, at 5,000 to 7,000 feet altitude (597); Nevada.

Dryas octopetala, L.—South Park, Colorado, at 12,000 feet altitude

(399). Leaves oblong to subcordate, obtuse, crenately serrate, covered with a white tomentum beneath, and very veiny.

FALLUGIA* PARADOXA, Endl.—Shrubs 2–5° high, with young branches white; leaves ½–1½′ long; leafless branches terminated by the whitish flower, which is an inch or more in diameter, or later by the dense head of carpels with thin, woolly styles. Calyx-lobes acute and usually reflexed after the petals fall.—Santa Fé 58), and Arizona, Loew.

GEUM MACROPHYLLUM, Willd.—Colorado (380); Utah; Loew, in Arizona.

GEUM TRIFLORUM, Pursh.—Colorado (394).

GEUM RIVALE, L.—Colorado (381).

GEUM ROSSII, Seringe.—Colorado, alpine, reaching as high as 13,500 feet (385, 387); Utah.

FRAGARIA VIRGINIANA, Duchesne.—Colorado (402). Var. *glauca*, Watson.

POTENTILLA GLANDULOSA, Lindl., var. *Nevadensis*, S Watson.—(379.) Collected in Colorado in 1873. It is a true *P. glandulosa*, Lindl., and hence the same as *P. fissa*, Nutt., differing from the above only in having more flowers in its less compact cyme. The Survey has it also from Utah.

POTENTILLA RIVALIS, Nutt.—South Park (373).

POTENTILLA PENNSYLVANICA, L.—South Park and Twin Lakes, Colorado (374, 375); Utah.

POTENTILLA HIPPIANA, Lehm.—White tomentose throughout, 1° high; leaflets 7–11, decreasing regularly in size from the terminal one down, ½–1′ long, deeply and sharply serrate; 1–2 smaller leaves on the stem; bractlets a little shorter and petals a little longer than the sepals. Flowers yellow; styles terminal, filiform; carpels glabrous.—Colorado (367, 209) and Arizona (220).

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*FALLUGIA, Endl.—Tube of the persistent calyx obconic-hemispherical. At the apex 5-bracteolate; lobes 5, ovate; apex 3-dentate, or 3-cuspidate, imbricated. Petals 5, large, obovate-rotund. Stamens many, inserted in a dense 3-fold series; filaments filiform, united into a ring at the base; anthers small. Torus sulcate, villous, many carpels on the small conical receptacle; style terminal, villous; stigmas small, a single ascending ovule in the base of the cell, the many villose achenia terminated by very long, plumose styles. Seed erect; testa membranaceous; cotyledons linear-oblong; radicle inferior.—An erect, much branched shrub, with virgate branchlets. Leaves alternate, petioled, irregularly 3–5-cleft or pinnatifid. Stipules adnate to the petiole. Flowers solitary on the apex of the branches, or sub-paniculate on elongated, leafless branches, bractless, rather large.—BENTHAM & HOOKER.

Potentilla Plattensis, Nutt.—Sparingly covered throughout with an appressed silky pubescence, low, 4–8′ long, branching from the root; leaves 2–4′ long, pinnate, with 11–13 leaflets, each of which is cuneate in outline, and deeply cleft into 5–7 linear lobes; flowers in an open cyme, on long, slender pedicels, less than ½′ in diameter, bright yellow; bractlets half shorter than the calyx-lobes; carpels rather indefinite, but about 30; styles filiform and terminal.—Twin Lakes, Colorado (346, 377).

Potentilla gracilis, Dougl.—Colorado (368, 372); Utah.

Var. rigida, Watson.—A larger and more villose form, with loose inflorescence, and larger, more veiny leaves. Same variety also from Utah.

Potentilla dissecta, Pursh.—Low, alpine, villose, with soft, spreading hairs, or glabrous, usually decumbent, 3–10′ long; leaflets 3–7, pinnate or digitate, glaucous, cuneate-oblong, serrate or even pinnately cleft, with the divisions tipped with long, whitish hairs; receptacle very villous; style filiform, terminal.—Colorado (371, 378).

Potentilla humifusa, Nutt.—Spreading, herbaceous, perennial; leaves densely white tomentose on the under surface, greener and villose on the upper surface; leaflets 3–5, cuneate-oblong, with 3–5 rounded teeth at the apex of each leaflet; stems few-flowered, 3–4′ long; calyx-lobes larger than the bractlets; both calyx and bractlets densely villose; petals 2″ long; styles terminal, filiform.—Colorado (365).

Potentilla nivea, L.—Colorado (366).

Potentilla Thurberi, Gray (Pl. Nov. Thurb. p. 318).—Herbaceous, perennial, 1–2° high, ascending, loosely villose, with *long*, spreading hairs; leaves digitate, upper sessile or nearly so, lower petioled, commonly 5-, sometimes 7-foliolate; leaflets obovately-cuneiform, regularly, deeply, and sharply serrate, lower surface canescent and villose gray or white, upper puberulent and green (smoother when old); stipules lanceolate or ovate, united to the petiole for one-fourth their length; bractlets lanceolate, acute, about as long as the sepals, though somewhat narrower, more or less villose; petals deep purple, broadly obcordate, about as long as the sepals; style terminal; carpels glabrous; disk thickened somewhat, 5-angled, with an inner circle of 5 stamens, with rather fleshy filaments inserted (one) on each angle; outer stamens with more filiform filaments; receptacle

hairy.—Ash Creek, Arizona, at 5,225 feet altitude (310), and Mount Graham, Arizona, at 9,250 feet altitude (399). The form from Mount Graham is decidedly the more villose.

POTENTILLA FRUTICOSA, L.—Colorado (383). Var. *Alpina*, Watson.—"Low and compact, the leaves very short (2 lines long), linear and revolute; same as 342. [Watson in vol. v, King's Report], Utah."

POTENTILLA ANSERINA, L.—Utah; Colorado (382).

SIBBALDIA PROCUMBENS, L.—Colorado, at 11,000 feet altitude, (403). Though Torrey and Gray (Fl. N. Amer.) state the only difference between *Sibbaldia* and *Potentilla* is in the minute petals and fewer pistils and stamens of the former, and though Bentham and Hooker (in Gen. Plant.) do actually unite these genera, I have refrained from following so reliable authorities, because Mr. Watson has excluded *Sibbaldia*, *Horkelia*, and *Ivesia* from his revision of *Potentilla*. At the same time I do not hesitate to express my opinion that the distinction between *Potentilla* and *Sibbaldia* will not stand.

IVESIA* DEPAUPERATA, Gray (in Herb.) and Brewer and Watson (in Fl. Cal.). *Potentilla depauperata*, Engelm. (Gray, in Proc. Am. Acad. vol. vii, p. 399).—Villose throughout, 1–1½° high; stem-leaves with 10–20 pairs of leaflets, 2–4″ long, 2″ wide, 3-lobed or parted, thickish, villose-pubescent; inflorescence cymose-paniculate; bractlets about half as long as the *purple* calyx-lobes; stamens 5; filaments filiform, opposite the calyx-lobes and in the sinuses of the adherent, 5-angled disk; ovaries 2, or frequently 1 aborting as the other developes, immersed in the disk, the mouth of which is filled with erect, rather stiff, white hairs.—San Francisco Mountains, Arizona (369, Loew).

IVESIA GORDONI, Torr. & Gray.—Buffalo Peak, Colorado, 12,000 feet altitude (386). One single location found, and only a few specimens, in a clump of *Geum Rossii*.

CHAMÆRHODOS† ERECTA, Bunge.—2–4′ high, villose pubescent, branch-

*IVESIA, T. & G.—"Calyx campanulate, or cyathiform at base, 10-cleft. Stamens definite (5, 10, 15, 20); filaments slender, narrowly subulate or filiform. Carpels few, sometimes solitary, upon a small villous receptacle; style subterminal. Leaves pinnate, leaflets very numerous, small, palmate or pedately-parted, closely crowded, sometimes quasi-verticillate or imbricate on all sides of the rachis; petals broadly obovate, scarcely unguiculate, becoming spatulate."—GRAY, Proc. Am. Acad. vi, 530.

†CHAMÆRHODOS, Bunge.—Calyx without bractlets, 5 erect lobes, valvate. Stamens short, opposite to the petals. Disk lining the calyx-tube, the margin with a thick crown of rather rigid hairs. Achenia 5–10; styles arising from near the base of the ovaries, where they are articulated, deciduous, slightly

ing from the root; radical leaves on petioles an inch long, ternately divided and many-cleft; segments linear, obtuse, cauline, 3–5-parted. Petals small, 1–2″ long, spatulate, equalling or exceeding the sepals—Colorado (703, 876).

Agrimonia Eupatoria, L.—Collected by Professor Loew, but neither date nor locality given. Probably from Arizona or New Mexico.

Rosa blanda, Ait. Colorado (391); Utah. Var. *β* (Fl. N. Am. T. & G. 1, p. 460).—With leaflets smaller and some of them puberulent beneath; appendages to the calyx-lobes are also somewhat smaller than in the average *R. blanda.* From the solitary specimen I have I should be inclined to consider it a distinct species.—Willow Spring, Arizona, at an altitude of 7,195 feet (236).

Rosa Arkansana, Porter (Fl. Col., p. 38).—"Stem stout, erect, leafy, 1° high, glabrous and glaucous, armed with weak, deciduous, bristly prickles; leaflets 9–11, ovate and oblong-ovate, 1′ or more in length, acute or obtuse, glabrous, sharply serrate; midrib and long stipules somewhat prickly and minutely glandular; flowers numerous, terminal, corymbed on pedunclcs, about 1′ long; fruit globose, smooth, glaucous; calyx-segments ovate, reflexed in fruit, with terminal and sometimes lateral appendages, more or less glandular and tomentose-pubescent on the margins; petals broadly obcordate or emarginate, longer than the calyx-segments; flower 2′ in diameter" (Porter, *l. c.*). This, as remarked by Professor Porter, may only be an extreme form of *R. blanda;* to which it has been referred by Crepin—Twin Lakes, Colorado (390).

Rosa fraxinifolia, Bork.—Differs from *R. blanda* chiefly in the greater size of its leaflets and fruit; the former being sometimes 1½′ long and 1′ wide, and the latter "6–8″ in diameter". The flowers are also larger and the pubescence greater, though in these respects this species varies widely. I am indebted to Dr. Vasey for calling my attention to the fact that this (393), which I had placed under *R. blanda* in the Enumeration of Colorado Plants (1874), is a different species. This is now placed by Mr. Watson, in Index Am Bot. p. 312, under *R. Nutkana,* Presl.—Colorado.

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capitate, single ovule ascending from the base of the cell; radicle superior.—Glandular pilose herbs with woody bases, and with short, leafy branches. Stipules adnate to the petiole. Flowers white or purple.—Bentham & Hooker.

Rosa Californica, Ch. & Schl.—The Survey has specimens from Nevada and Utah, which, according to Mr. Watson, are the same as those considered by him in King's Report as *R. blanda.*

Amelanchier alnifolia, Nutt.—Colorado (396); Nevada.

SAXIFRAGEÆ.

Saxifraga Hirculus, L.—Stem 2–8′ high, strict, and with lanceolate, entire leaves (at base 3–6″ long), regularly diminishing in size to the summit of the stem; pedicels and summit of the stem more or less densely clothed with a rusty tomentum (nearly glabrous sometimes); flowers 1–4, yellow, 5–8″ in diameter; sepals obtuse, reflexed, and one-fourth as long as the petals.—Twin Lakes, Colorado (799).

Saxifraga chrysantha, Gray (Proc. Am. Acad. xii, p. 83). (*S. serpyllifolia*, Gray, in Report of Wheeler's Survey, 1874.) Perennial, stolons creeping, leafy, filiform; leaves at base of scape spatulate, obtuse, 2–4″ long, entire, thickish, shining, midrib indistinct; scape, 1–2-flowered, 1–3′ high, slender, with 2–6 bract-like leaves; flowers bright yellow, 6–8″ in diameter; petals sessile or with a very short claw, truncate at base, rounded at apex, 2–3 times longer than the reflexed sepals; slightly 2-lobed capsule broad-ovate.—Silver Heels Mountain, Colorado, at 12,000 feet altitude (799 *bis*).

Saxifraga flagellaris, Willd.—South Park, Colorado, at 12,500 feet altitude (797).

Saxifraga bronchialis, L.—Stems ascending, 1–6′ high, from among the old leaves of the previous year; radical leaves lanceolate, acute, densely crowded, and ciliated with projecting, cartilaginous hairs, mucronate, 3–7″ long. Stem-leaves linear, less ciliated, and somewhat appressed to the stem; flowers corymbose, with a bract at each branch of the corymb; petals white, spotted with purple, exceeding the sepals.—Twin Lakes, Colorado (802).

Saxifraga adscendens, L. (*S. controversa*, Sternb.)—Low, 1–2′ high; root-leaves clustered, somewhat cuneate at base and 3-parted at the apex; short stems with a few bract-like leaves, few-flowered; calyx-lobes obtuse, not longer than the tube; petals yellowish white, a little longer than the

calyx; entire plant more or less glandular puberulent, though sometimes almost smooth.—Mountains of Colorado (798).

SAXIFRAGA PUNCTATA, L. (*S. æstivalis*, Fisch.)—Colorado, moist, shady ravines, at 11,000 feet altitude (803); Utah.

SAXIFRAGA NIVALIS, L.—Same as our Eastern *S. Virginiensis*, Michx. Colorado, 10,000 feet altitude.

SAXIFRAGA INTEGRIFOLIA, Hook. (193, *S. nivalis*, var., Parry, Hall & Harbour Coll., 1862.)—Half-Moon Creek, Colorado, in damp cold ground, at 11,000 feet altitude (796).

TELLIMA TENELLA, Walp. Rep. (*Lithophragma*, Nutt.)—Colorado, west of the main range (800, 982).

HEUCHERA SANGUINEA, Engelm.—1–2° high; scape smooth, naked, or with one or two small, bract-like leaves; leaves clustered near the ground, on petioles 1–3′ long, round, cordate at base, indistinctly 5–7-lobed, with lobes again divided; margins ciliate and roundish, teeth mucronate-pointed; petiole and midrib pilose; flowers paniculate, deep red; lobes of the calyx obtuse, denticulate; petals slightly exserted, nearly round, denticulate; stamens and style included—Limestone ledges, Sanoita Valley, Arizona, at 5,000 feet altitude (673). A very showy plant, and well worth cultivation.

HEUCHERA RUBESCENS, Torr. (Stansb. Rep. p. 388, t. 5).—Mount Graham, at 9,000 feet altitude (411).

HEUCHERA PARVIFOLIA, Nutt.—Colorado (804, 805), and rocky banks on Santa Fé Creek, New Mexico (61).

PARNASSIA FIMBRIATA, Koenig.—Twin Lakes, Colorado (65).

JAMESIA AMERICANA, T. & G.—Colorado, at middle altitudes, in rocky places (68), and near Santa Fé, N. Mex. (50).

RIBES OXYCANTHOIDES, L. (South Park, Colorado, 8, 11), is, according to Brewer and Watson (Fl. Cal. 1, p. 206), *R. hirtellum*, Mich.

RIBES LEPTANTHUM, Gray (Pl. Fendl. p. 53).—Poncho Pass, Colorado, Utah (4 and 7).

RIBES LACUSTRE, Poir., var. SETOSUM, Gray.—Differing from the species in its hispid fruit, prickly *young* branches, fewer-flowered racemes, and smaller leaves.—Colorado (3).

RIBES CEREUM, Dougl.—Widely diffused. The expedition has it from Colorado (6), Zuñi Mountains, New Mexico (176), and Nevada. The specimens from the Zuñi Mountains exactly resemble those collected in 1851 by Sitgreaves' Expedition, and identified by Dr. Torrey.

RIBES VISCOSISSIMUM, Pursh.—Utah.

RIBES AUREUM, Pursh.—San Luis Valley, Colorado (10). Northern Nevada also.

RIBES AUREUM, Pursh, var. *tenuiflorum*, Torr. (*Ribes tenuiflorum*, Lindl.)—Distinguishable by having smaller flowers and fruit than *aureum* proper, yet closely shading into it.—New Mexico (109). Specimens insufficient.

RIBES WOLFII, Rothrock (in American Naturalist, June, 1874). (*R. sanguineum*, Pursh, var. *variegatum*, Watson, King's Report, vol. v, p. 100.)—2 to 4 feet high. Neither prickly nor spiny. Moderately branching. Young branches light brown, minutely glandular-pubescent, somewhat angular by two ridges continued from the edges of the expanded bases of the petioles above. Branches of the previous year ashy-gray, with a deciduous epidermis, which, on being shed, shows the bark underneath dark brown.

Leaves cordate-orbicular, deeply 5-cleft; lobes rather obtuse, unequally serrate, though hardly doubly serrate (average diameter of the largest leaves 2 to $2\frac{1}{2}$ inches; depth of sinus at base in largest leaves $\frac{1}{2}$ inch), slightly viscid; under surface with a few glandular hairs, pale green; upper surface smoother and deeper green; petioles *in fully developed leaves* from 1 to $1\frac{1}{3}$ inches long, margined by a continuation of the veins of the blade, expanded at base and becoming semi-amplexicaul, frequently *strongly* pectinately ciliate and glandular.

Peduncles 1 to 2 inches long, decidedly glandular-pubescent, 4- to 10-flowered; bracts ovate-spatulate, obtuse, yellowish-white (occasionally verging toward red), 1 to $1\frac{1}{2}$ lines long and 1 line shorter than the pedicels, which are a little longer than the flower.

Sepals red, lanceolate, obtuse, $1\frac{1}{2}$ lines long, *never reflexed;* petals red, ovate-spatulate, half as long as the sepals, equalling the stamens; styles two, distinctly conical from the top of the ovary, red for half their length, parted to or below the middle, recurved; stigmas slightly capitate.

Young fruit strongly glandular hairy, but never prickly, becoming smoother with age; mature fruit maroon or reddish-purple, globose, three-eighths of an inch in diameter, few- to many-seeded, edible; seeds distinctly wing-margined, with the inner coat, as seen through the gelatinous covering, longitudinally dotted.

It will be seen that this plant approaches both *R. glutinosum*, Benth., and *R. sanguineum*, Pursh, though its nearer affinity is with the latter. It is distinguished from the former in being fewer-flowered, having shorter racemes and a rounder berry, and from the latter by its shorter racemes, relatively shorter bracts and longer pedicels, and erect calyx-lobes. It may prove to be a mere variety of *R. sanguineum*, though I think it sufficiently distinct to bear the name of its zealous discoverer, Professor Wolf.

Habitat.—Rocky places, at Twin Lakes and Mosquito Pass, at an altitude of from 10,000 to 11,000 feet.

CRASSULACEÆ.

TILLÆA ANGUSTIFOLIA, Nutt.—Twin Lakes, Colorado (972, 326).

SEDUM RHODIOLA, DC.—South Park, Colorado (771).

SEDUM WRIGHTII, Gray.—2–6′ high; stems ascending from a decumbent base; radical leaves 2–4″ long, obovate-spatulate, slightly pulverulent, margin whitish, very slightly denticulate; stem-leaves (and stem) purple-tinged, lanceolate, 3–5″ long; inflorescence densely cymose, secund; petals 5, white, with a tinge of red, apiculate, twice as long as the obtuse sepals; carpels abruptly contracted into a long, slender style.—Mount Graham, Arizona, at 9,000 feet altitude, sending its fibrous roots down into the crevices of the damp rocks (756).

SEDUM RHODANTHUM, Gray.—Colorado (769, 326).

SEDUM STENOPETALUM, Pursh.—South Park, Colorado (770).

HALORAGEÆ.

HIPPURIS VULGARIS, L.—Colorado, not rare (118).

CALLITRICHE VERNA, L.—Twin Lakes (314).

CALLITRICHE AUTUMNALIS, L.—Rio Grande at Loma, Colorado (987).

LYTHRARIEÆ.

CUPHEA WRIGHTII, Gray (Pl. Wright. 2, p. 56).—Annual, 6–12′ high, unbranched; stem, pedicels, and capsules viscidly pubescent or hispid; leaves lanceolate to oblong, 6–10″ long, petioled, gradually reduced to bracts, glabrous or nearly so; flowers either solitary or two or three in the axils; calyx with an inconspicuous spur, 3″ long, naked in the throat; pedicels 3″ long; purple petals hardly 2″ long; stamens included; anthers, style, and seed smooth.—Sanoita Valley, Arizona (630).

LYTHRUM ALATUM, Pursh, var. LANCEOLATUM, T. & G.—"Leaves lanceolate or elliptical, mostly opposite or whorled, acute at the base, often a little petioled, the upper ones much crowded, often shorter than the flowers" (T. & G. Fl. N. Am. p. 481).—Nevada.

Var. LINEARIFOLIUM, Gray. (*L. Californicum*, T. & G.)—I have a set of specimens (309) from Ash Creek, Arizona, differing, so far as I can see, from this form in nothing except that the accessory calyx-teeth are not quite obsolete.

ONAGRARIEÆ.

EPILOBIUM ANGUSTIFOLIUM, L.—Colorado (143); Mount Graham, Arizona, at 9,000 feet altitude (438).

EPILOBIUM LATIFOLIUM, L.—Twin Lakes. Altitude, 9,600 feet. Wet, rocky places. August. We have in the collection the extreme forms of broadly lanceolate and narrow, lanceolate-linear leaves, with all gradations between. (142.)

EPILOBIUM TETRAGONUM, L.—Twin Lakes, Colorado (145, 153, 156); Nevada and Utah.

EPILOBIUM COLORATUM, Muhl.—Colorado (154).

EPILOBIUM PALUSTRE, L. var. *β.* ALBIFLORUM, T. & G.—(156 *bis.*) These specimens were intermixed with 156 in the retained collection. So plainly marked were their characteristics—*i. e.*, leaves entire, lance-linear, obtuse; stem few-flowered; flowers almost white; capsule hoary, at first almost sessile, afterward with a long pedicel—that I am half inclined to keep the form distinct as a species. Except for its manifesting little or no tendency to branch, it would be exactly *E. rosmarinifolium* of Pursh, Fl. 1, p. 259.—South Park, Colorado. Altitude, 9,900 feet.

EPILOBIUM PANICULATUM, Nutt.—Utah; San Luis Valley, Southern Colorado, at 6,400 feet altitude.

ZAUSCHNERIA CALIFORNICA, Presl.—Extending from California to Eastern Arizona.

GAYOPHYTUM RAMOSISSIMUM, T. & G.—Nevada; Colorado (150, 146, 147).

GAYOPHYTUM RACEMOSUM, T. & G.—Utah.

ŒNOTHERA BIENNIS, L.—Utah and San Luis Valley, Colorado (131, 141). Var. *grandiflora*, T. & G.—Nevada.

Var. HIRSUTISSIMA, Gray. (*Œ. Hookeri*, Torr. & Gray.)—Close to the last—*i. e.*, var. *grandiflora*—but with a very hirsute ovary.—Sanoita Valley, Arizona (658).

ŒNOTHERA SINUATA, L., var. GRANDIFLORA, S. Watson.—A poor specimen of what I take to be the above is found in the collection from Arizona, though I find it has hardly free tips to the calyx-lobes, and the flowers are nodding in the bud; seeds not seen. In this and the next species, there is a great difference in the length of the styles in plants from the same immediate locality, though it hardly suggests the idea of dimorphism.

ŒNOTHERA PINNATIFIDA, Nutt.—Usually erect and somewhat branched, canescently pubescent and more or less hirsute; lower leaves petioled, entire, serrate or pinnatifid, upper ones linear-lanceolate, deeply and somewhat irregularly pinnatifid; capsule sessile, linear, tapering, hirsute, 1′ long; calyx-tube slender, dilating gradually, 2′ long; petals white or rose color, 1′ in diameter; calyx-lobes reflexed, not more than 1′ long, tips hardly free; seeds yellow, strongly pitted, slightly apiculate and oval.—Southern Arizona (318, 377); Colorado (125).

ŒNOTHERA TRICHOCALYX, Nutt.—Erect, 4° high, tomentose or somewhat canescent, hirsute; leaves sessile, tapering (in my specimens) into a petiole, oblanceolate, sinuate, denticulate; capsule sessile, linear, tapering upward slightly; seeds in a single row; calyx-tube $1\frac{3}{4}'$ long, calyx-tips free, throat naked; petals yellow, $1\frac{1}{2}'$ long. Mr. Watson, to whom I am so greatly indebted, doubtfully assigns this rather rare plant here, adding in his remarks that it is 1068 of Wright.—Willow Spring, Arizona, at 7,195 feet altitude (223).

ŒNOTHERA ALBICAULIS, Nutt.—Utah.

Var. RUNCINATA, Engelm.—Glabrous or canescently pubescent, much branched, often from the decumbent base; leaves sessile, or nearly so, narrowly lanceolate, sometimes entire, but more frequently runcinately pinnatifid in their whole length.—Arizona, Dr. Oscar Loew.

ŒNOTHERA CORONOPIFOLIA, T. & G.—Twin Lakes, Colorado, at 9,500 feet altitude (126).

ŒNOTHERA ROSEA, Ait.—Slender, branching from the base, sparingly puberulent; leaves lanceolate, tapering rather gradually to the apex, attenuated into a petiole $\frac{1}{4}'$ long, entire or repandly denticulate; capsule ovate, 4-angled and 4-ribbed, 3–6″ long; calyx-tube 4″ long, longer than the lobes; petals bright rose color, equal to or somewhat shorter than the calyx-tube; seeds nearly smooth.—Cienega (near Tucson), Ariz. (563).

ŒNOTHERA CÆSPITOSA, Nutt.—Acaulescent, or with a very short stem, about 5′ high, more or less hirsute, especially on the margins and principal veins of the leaves; leaves broadly lanceolate, 2–8′ long, attenuate into a long petiole, rather acute, irregularly and sometimes deeply sinuate-toothed; calyx-tube 2–5′ long, tips of the lobes united *in the bud;* capsules oblong, over an inch in length, strongly ribbed; "seeds in 2 rows in each cell, oval-oblong, not angled, very minutely and densely tubercled upon the back with thin flattened processes and with a narrow, longitudinal furrow on the ventral side."—South Park, Colorado, at 9,900 feet altitude (132).

ŒNOTHERA TRILOBA, Nutt.—Calyx-tube 2–7′ long; tips of the lobes free; petals obovate, $\frac{1}{2}$–2′ long (the specimens giving so unusual a size of flower were from Willow Spring, Arizona); capsule 4-toothed, at the apex broadly 4-winged; seeds 1–$1\frac{1}{2}$″ long, angled, obscurely but densely tuberculate.—Willow Spring, Arizona (239); Denver and Twin Lakes, Colorado (123).

ŒNOTHERA NUTTALLII, T. & G.

ŒNOTHERA HETERANTHA, Nutt.—Utah.

ŒNOTHERA HARTWEGI, Benth.—Suffruticose, usually about a foot high, branched (especially above); bark frequently shedding, as in *Œ. Californica,* pubescent, though sometimes glabrous; leaves lanceolate, entire or irregularly repandly denticulate, somewhat ciliate, 8″–$1\frac{1}{2}'$ long; calyx-tube variable,

about 2′ long, broad in the throat; petals yellow, 6–12″ long; capsule ½–1′ long, hairy, though attenuated toward the base; seeds oval, indistinctly tuberculated; stamens shorter than the petals; stigma discoid.—Camp Bowie, Ariz. (460). Var. LAVANDULÆFOLIA, S. Watson. (*Œnothera lavandulæfolia*, T. & G.)—Much smaller; leaves linear, hairy, obtuse, 4–12″ long; calyx-tube much more slender and the "calyx-segments less attenuated above".—Collected by Dr. Loew in Arizona. Widely different in appearance. Var. *Fendleri*, S. Watson, may be usually known at a glance by being glabrous, having oblong lanceolate leaves and larger flowers, with a broad throat. It comes from the same region.

ŒNOTHERA GREGGII, Gray (Pl. Fendleri, p. 46).—"Scarcely more than a variety of the last. More shrubby and diffuse, low, viscidly pubescent or more or less hirsute; leaves ovate to oblong, 1–3′ long, acute, mostly sessile; flowers mostly terminal, calyx-tube slender, 8–15″; petals acutish, 3–6″ long, capsule ½′ long."—(WATSON, Proc. Am. Acad. viii, p. 590.) Arizona.

ŒNOTHERA ALYSSOIDES, Hook. & Arn.—Utah.

ŒNOTHERA BOOTHII, Dougl.—Nevada.

ŒNOTHERA SCAPOIDEA, Nutt.—Utah. Also, var. *purpurascens*. "Flowers larger, pinkish-white or purplish, rarely yellow, tube 2–3″ long; petals 3–4″ long."—(Watson.) Nevada.*

GAURA COCCINEA, Nutt.—Perennial, from a woody root, canescent; leaves lanceolate or linear, entire or irregularly sinuate dentate, ½–1¼′ long; bracts persistent, about as long as the mature fruit; reflexed calyx-lobes a little longer than the tube; style pilose at base; stigmatic indusium annular, margin entire or nearly so; fruit canescent, contracted in its lower third into a thick terete neck.—Nevada, Arizona, and Colorado (160, 161). Smooth form (159), Colorado.

GAURA sp.?, No. 233.—Willow Spring, Arizona, 7,195 feet altitude. In the absence of proper fruit, on which I must depend to aid in assigning this specimen to a place, I felt inclined to regard it as merely a form of *G. coccinea*, which the structure of the flower much resembles. Dr. Gray (who

* It is but just that I should state (what is, however, obvious) that in describing the species of *Œnothera* I have drawn largely upon Mr. Watson's admirable monograph of the genus. See Proc. Am. Acad. vol. viii, pp. 573–618.

has it, without fruit, from Dr. Palmer, obtained in New Mexico) is inclined to regard it as *G. Drummondii.* I believe it will prove distinct from either, in which case it might appropriately bear the name of *G. Palmeri.*

GAURA PARVIFOLIA, Torr. (in Ann. Lyc. New York, 2, p. 200). (*G. coccinea*, Nutt., var. of T. & G.)—Perennial, much branched from the base; branchlets, leaves, and fruit hoary puberulent; leaves $\frac{1}{4}$–$\frac{3}{4}'$ long, linear, irregularly and sparingly denticulate; calyx-tube 3–5″ long, a little longer than the lobes; stigmatic indusium *deeply 4-lobed*, and slightly folded around the lobes of the stigma; appendages to the filaments rather large, 1″ long; mature fruit suddenly contracted into a thickish neck at its lower third, above acutely 4-angled, intervening faces deeply concave, apex obtuse, acute, or even apiculate; style at base slightly villose. Evidently the nearer affinity of this plant is with *G. coccinea*, but since in addition to its smaller leaves the stigmatic indusium is constantly 4-lobed, I feel bound to keep up the distinction and restore the old name. The bracts too are smaller than in *G. coccinea*, and not caducous as in *G. Drummondii*, to which it has also some points of resemblance.—Cottonwood and Camp Grant, Ariz. (349).

GAURA SUFFULTA, Engelm. (Pl. Lindh. p. 196).—1–2° high, villose, bearded with long, spreading hairs; branchlets, flowers, and bracts glabrous; leaves smoothish, lanceolate, attenuated at either end, repand-denticulate, lower ones broader, petioled; rachis roughened by the adnate pedicels from which the fruit has fallen; fruit ovate-pyramidal, glabrous, acutely four-angled, sides concave and hardly roughened. Flowers sometimes trimerous; appendages at the base of the filaments rather large; stigmatic indusium 4-parted and free (its tips at least) from the stigma.—Arizona.

GAURA PARVIFLORA, Dougl.—Valley of the Gila, Arizona (768); Utah.

LOASEÆ.

CEVALLIA* SINUATA, Lagasca.—Genus of a single species so far as known.—Limestone rocks, Camp Bowie, Ariz. (480). Stings the hand like a genuine nettle.

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* CEVALLIA, Lag.—Tube of the plumose calyx short, oblong; 5 linear lobes erect. Petals 5, plumose, erect, as long as and similar to the sepals. Stamens 5, erect, filaments very short; anthers

PETALONYX THURBERI, Gray (Bot. Mexican Boundary, tab. 22).—Southern Nevada.

PETALONYX NITIDUS, Watson (Amer. Naturalist, 7, 300).—Differing from the above in having its leaves distinctly petioled, serrate, "vitreous and shiny" and nearly alike in size (1–1¼′ long) to the ends of the branches. Flowers also are in short, dense, cymose panicles.—Also from Southern Nevada.—PLATE IV. Fig. 1. Branch nearly natural size. 2. Flower. 3. A single petal. 4. Diagonal section through pistil showing the single suspended ovule and two calyx-lobes. All except the branch enlarged.

MENTZELIA NUDA, T. & G.—6–18′ high, very rough, with short, almost cartilaginous bristles, usually branched from the root; leaves linear or lanceolate, nearly entire, or deeply pinnatifid; exterior filaments more or less dilated, antheriferous; petals nearly or about twice as long as the linear calyx-segments; seeds very numerous, winged, and somewhat flat.—Colorado (764, 765); Fort Wingate, N. Mex., Professor Loew, coll.

MENTZELIA ASPERA, L.—Annual; usually slender leaves, 3-lobed (the terminal lobe largest, irregularly toothed); petioles 4″ long, slender; flowers sessile or nearly so; petals 2″ long, equalling the subulate calyx-teeth; capsule 1′ long, regularly club-shaped. The few flattish seeds pendulous, under the lens marked with curved longitudinal lines. Not winged.—Sanoita Valley, Arizona, at 6,000 feet altitude (642). I had doubtfully named this *M. albicaulis*, Dougl., but from Mr. Watson's description in Fl. Cal. 1, p. 235, have assigned it here. Number 928 of Thurber's collection is in part the same, but is under *M. albicaulis*.

MENTZELIA ALBICAULIS, Dougl.—Colorado (768); Nevada.

MENTZELIA LÆVICAULIS, T. & G.—Utah.

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linear-oblong, pilose, 2-lobed at base. connective produced beyond the anther-cells into an elongated sub-inflated process. Staminodia 0. Ovary inferior, 1-celled; style short, stigma ovoid. Solitary ovule hanging from the apex of the cell. Fruit dry, indehiscent, oblong or obovoid, crowned by the calyx and corolla. Exalbuminous seed, conformed in shape to the cell; testa membranaceous, smooth; cotyledons amygdaline; radicle very short.—Branching herbs, with the habit of *Scabiosa*, canescent-pubescent, setose, with larger simple bristles arising out of glands, smaller ones short, thick [transversely tubercular roughened]; bark white, shining. Sessile leaves alternate, sinuate-pinnatifid. Flowers terminating the peduncles, aggregated in hemispherical heads, silky hirsute. Involucre of linear-setaceous bracts.—BENTHAM & HOOKER.

CUCURBITACEÆ.

ELATERIUM* WRIGHTII, Gray (Pl. Wright. 2, p. 61).—Stem slender, pubescent; leaves reniform or cordate, obscurely 5-lobed or angled; sinus deep; apex *sometimes* distinctly triangular-acuminate, slightly scabrous on the under surface and nearly smooth above; margin ciliate, and sometimes slightly and remotely denticulate; male flowers rather few, in a slender raceme, on capillary pedicels, abundantly covered with minute, globular, stalked glands (the pedicels of which are manifest on the margins of the corolla-lobes); corolla adnate to the calyx, the lobes of which are reduced to mere teeth; fruit 1–1½′ long, 6″ in diameter, covered with glandular, hairy prickles.—Cienega, Ariz. (581). Beyond doubt identical with 951 of Mex. Bound. Survey.

APODANTHERA† UNDULATA, Gray (Pl. Wright. 2, p. 60).—Trailing vine, several feet long. Fruit 3–4′ in diameter.—Valley of the Rio Grande and Eastern Arizona (373).

CUCURBITA‡ DIGITATA, Gray (Pl. Wright. 2, p. 60).—"Root large, fleshy;

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*ELATERIUM, Linn.—Flowers monœcious. Male flowers in a long raceme. Calyx-tube urceolate, campanulate, or elongate-cylindrical. Corolla salver-shaped, tube short or elongated, inflated, or cylindrical; lobes oblong, linear or lanceolate. Filaments united into an elongated column; anthers united into a small oblong or globose head; linear cells sigmoid, flexuose; connective sometimes produced beyond the cells. No rudiment of an ovary. Female flowers solitary. Calyx and corolla as in the male flowers. No rudimentary stamens. Ovary obliquely ovoid, rostrate, hispid, or echinate, 1-6-celled, often 3-celled with 2 cells many-ovuled and the third empty, rarely 4-celled with one or two of them empty, or with 4 small cells, 2 above and 2 below; style columnar or filiform, contracted under the large capitate stigma; ovules in cells 2–many, or a single ovule in each of the cellules. Fruit obliquely ovoid, rostrate, gibbous, fleshy, 1–many-celled ("dehiscent at the apex," Gray). Seeds flat, with the margins often crenulate.—Annual, climbing herbs, smooth or pubescent. Leaves cordate, entire, lobed or parted. Tendrils 2–3-parted.—BENTHAM & HOOKER.

†APODANTHERA, Arn.—Flowers monœcious or diœcious. Male flowers racemose. Tube of the calyx funnel-shaped or cylindrical, dilated at the base, lobes 5, subulate. Corolla rotate, deeply 5-parted; segments oblong or linear. Stamens 3 or 4, sessile in the throat of the calyx; anthers linear, connate in the middle; one, or two 1-celled, the remainder 2-celled, cells nearly straight, connective not produced. No rudimentary ovary. Female flowers solitary. Calyx as in the male, but more urceolate. Corolla like the male. No rudimentary stamens! Ovary ovoid, with 3 placentas; style columnar, with a 3-lobed fleshy stigma; ovules many, horizontal. Fruit fleshy, ovoid.—Climbing or prostrate herbs, pubescent or hispid. Leaves round, reniform, entire, or somewhat lobed. Flowers rather large, yellow.—BENTHAM & HOOKER.

‡CUCURBITA, Linn.—Flowers monœcious, all solitary. Male flower:—Calyx-tube campanulate, rarely elongated, lobes 5; simple or foliaceous. Corolla campanulate, cleft to or below the middle. Apices of the lobes recurved. Stamens 3, inserted in the bottom of the calyx; filaments free; anthers linear, confluent into a head, one, 1-celled; two, 2-celled; cells elongated, sigmoid flexuose. No rudiments of an ovary. Female flowers:—Calyx and corolla as in the male. Three rudimentary stamens in the bottom of the calyx. Ovary oblong, with 3 placentas; style short, stigmas 3, 2-lobed or forked; ovules many, horizontal. Fruit a berry, fleshy, often with a thick rind, indehiscent

branches prostrate, running 10–20 feet." Segments of the upper leaves 2–4″ wide and 3′ long; lower leaves wider and shorter, somewhat lobed. Corolla yellow, 3′ long, funnel-shaped.—Arizona (441). Fruit 3′ in diameter, green, with white, longitudinal stripes.

CACTEÆ.

By Dr. George Engelmann.

Mamillaria (Coryphantha) vivipara, Haworth, Engelm. in Watson's Bot. King's Expl. 117.—A common plant on the Western plains from the Missouri to Texas, extending in the mountain regions as far west as Arizona and South Utah, the large, deep rose-colored or purple flowers, with fringed sepals and lance-linear, acuminate petals, green, oval berries, with light brown, pitted seeds, readily distinguish the species. The form of the plains is lower and often densely cespitose-spreading; the mountain plant is often simple and larger. The largest form, which comes from Arizona, I had at one time distinguished as *M. Arizonica*, but must now consider it as only a gigantic *vivipara*, 3–5′ high, 4′ in diameter, with spines often over 1′ long on rather broad and spreading tubercles. Rothrock, 1874, (203), is a smaller form, from Camp Apache, Ariz.

Mamillaria (Coryphantha) chlorantha, n. sp.—Similar to the last, but with broader yellow petals; stems oval to cylindrical, 3′ wide, sometimes 8–9′ high; tubercles compressed from above; 20–25 outer spines gray, almost in 2 series; 6–8 or 9 inner ones stouter, ½–1′ long, reddish or brownish only at the tip; flowers yellowish or greenish-yellow, crowded on the top of the plant, 1½′ long and wide, often 1–2 small, fringed sepals on the ovary (which also occasionally is seen in *vivipara*); sepals lanceolate, fringed; petals lanceolate or linear-lanceolate, acute, denticulate; 7–9 whitish stigmas, erect-spreading.—Southern Utah, east of Saint George, Dr. Parry. I. E. Johnson.

Echinocactus Wislizeni, Engelm.—Very large, often over 3° high and half as much in diameter; at first globose, then ovate to cylindrical,

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and many-seeded. Seeds ovate or oblong. Stems annual, roots perennial, often procumbent and rooting. Leaves cordate at base and lobed. Tendrils 2-many-cleft. Flowers large, yellow. Fruit often very large.—Bentham & Hooker.

with 21–25 rather sharp ribs; the large linear-oblong areolæ (very woolly when young) bear three kinds of spines, first, 4 very stout, annulated, reddish ones, 1½–2½′ long, the 3 upper ones straight, the lower one hooked; second, 3–5 lower and usually 3 uppermost spines, slender, but straight, stiff, and annulated, of reddish color; third, 12–20 whitish, bristle-like, flexuous, lateral spines: flowers 2–2½′ long, 1½ wide, yellow, outside greenish with purple-brown; ovary and fruit imbricately covered with numerous (50–60) cordate or reniform crenulate sepals; sepals of tube oblong, ciliate; petals broadly linear, crenate, bristle-pointed; style deeply divided into 12–18 linear stigmas; seeds 1″ long or over, reticulate or shallow-pitted.—Southern New Mexico.

Var. Le Contei. (*E. Le Contei*, Engelm.)—At last clavate from a slender base; lower central spine more flattened, curved or twisted, but not hooked; flower rather smaller and with fewer parts.—This is the Western form, from South Utah and Arizona to and beyond the Colorado River. Dr. Rothrock collected, at Camp Bowie, Ariz., a peculiar form (492), which may represent another variety, *decipiens:* globose, 1° in diameter; spines shorter and fewer, no straight spines above the 4 central ones, none longer than 1–1½ inches; 10–15 thin flexuous spines on side and upper end of areolæ; only 20–25 sepals on ovary.

Echinocactus polycephalus, Engelm. & Bigel. (see Watson in Bot. King's Expl.117).—From the Mojave region to Southwestern Utah. The numerous spiny-bristly sepals, and the linear, acute, yellow petals almost hidden in a dense cottony wool.

Echinocactus Whipplei, Engelm. & Bigel; Watson, *l. c.* 116.—On the Lower Colorado River and northward into Utah.

Cereus (Echinocereus) Engelmanni, Parry; Watson, *l. c.* 117.—Throughout Arizona and into Utah and Southern California. Flower purple, open only in mid-day sunshine.—Camp Bowie (1002), Mrs. Major Sumner. Flower only. May be this or an allied species.

Cereus (Echinocereus) phœniceus, Engelm.—Globose or oval heads, 2–3′ high, about 2′ in diameter, several to a great many (sometimes over 100) from one base, 8–11-ribbed; 8–15 slender, but straight, stiff, and very brittle spines in each bunch, ½–1½′ long, 1–3 of them more central and

a little stouter; deep red flowers, 1½–2½′ long, half as wide, open equally day and night, spatulate, rather stiff petals, rounded at tip.—From West Texas to Southern Colorado and Arizona, as far west as the San Francisco Mountains, Bigelow, and from Fort Whipple, Palmer.

Cereus (Echinocereus) triglochidiatus, Engelm.—Few (2–5) globose or oval heads, 2–4′ high, 2–2½ thick, 6–7-ribbed; areolæ more distant than in the last; spines fewer, only 3–6, flattened or angular, usually curved, about 1′ long; flowers same as in last.—New Mexico, Santa Fé, 1874, Rothrock (39). *C. gonacanthus*, Engel. & Bigel., which extends from New Mexico to the Arkansas River and westward to Zuñi, and is characterized by its stouter, longer, and more numerous spines, may belong to this species; and perhaps both, with numerous other so-called species, which vary only in the number of the ribs, the number or form of the spines, and the closeness of the spine-bunches, but have all similar flowers, may have to be considered as forms of one polymorphous type (*C. phœniceus*).

Opuntia (Platopuntia) basilaris, Engelm. & Bigel.—A low plant, with broadly obovate, often retuse or fan-shaped joints, branching mostly from the base, pubescent, as well as the fruit; areolæ very close, without spines, but densely covered with short, yellowish-brown bristles; flowers large, rose-purple; fruit dry, subglobose, with rather few, large and thick seeds.—Southeastern California to Arizona. Distinct from all other species of this region by its mode of growth, its pubescence, the absence of spines proper, and the very large (3½–5″ wide) seeds. The large purple flowers, which in the season completely cover the plant, make a beautiful show.

Opuntia (Platopuntia) Missouriensis, DC.—Santa Fé, N. Mex., 1874, Rothrock (6). Common from the plains of the Missouri into the mountains. A low, very spiny (whence Nuttall's name, *O. ferox*) species, with yellow or sometimes (on the Upper Arkansas plains) purple flowers, and dry spiny pods, which contain large, much compressed, and broadly margined seeds.—Several more, probably half a dozen, flat-jointed *Opuntiæ* have been noticed in Arizona, some prostrate and with smaller joints; others tall, erect, with large joints (to a foot or more in length), many of them very spiny; of them not much is known, as the plants are difficult

to preserve and flowers and fruit have not often been found or collected. Full notes, living joints, good fruit and seed, and pressed flowers are desirable, to make us sufficiently acquainted with these plants. The best method of preserving the flowers is to split them open before attempting to dry them. Living plants or joints are very valuable, but alone are not sufficient, because in cultivation they very rarely flower and scarcely ever bear fruit.

OPUNTIA (CYLINDROPUNTIA) CLAVATA, Engelm.—A low, cespitose plant, with short (1–3′ high, 1′ thick), clavate, ascending, strongly tuberculate joints, the upper areolæ bearing 4–7 ebony-white, flattened, striate spines, surrounded by a number of smaller, bristly ones; yellow flowers, 2′ wide; dry, yellow, oval pod, covered with numerous, large, woolly, and long-bristled areolæ.—El Rito, New Mexico, Rothrock, in 1874 (92). Also about Santa Fé, etc.

OPUNTIA (CYLINDROPUNTIA) PULCHELLA, Engelm. (see Watson's Bot. King's Expl. 119; Simpson's Report, Botany, t. 3).—A very small, purple-flowered species of Nevada. A flower brought home by Mr. Bischoff was, by a singular error, enumerated in the Catalogue of 1874 as *Cereus viridiflorus*.

OPUNTIA (CYLINDROPUNTIA) ARBORESCENS, Engelm. (see Watson, *l. c.* 120).—Cuero, New Mexico (101), Rothrock, in 1874; Cienega, South Arizona (near Tucson), the same (584); and from Camp Bowie, Ariz. (1002), by Mrs. Major Sumner. This handsome species extends northward to the plains of Colorado and Pike's Peak, covering extensive tracts. Remarkable for its horizontal, often whorled, branches; purple flowers, 2–2½′ in diameter; ovary often with some spiny bristles, which at maturity disappear. The skeleton, as the cactus wood is rather fancifully called after the soft tissues have rotted away, forms a heavy, hollow cylinder, with regular rhombic holes or meshes corresponding to the tubercles and spine-bunches of the plant, and makes excellent canes. This species is closely allied to the Mexican *O. imbricata* and *O. decipiens*, *arborescens* being the northern, larger-flowered form, but the seeds are different.

OPUNTIA (CYLINDROPUNTIA) BIGELOVII, Engelm. (Pac. R. R. Rep. 4,

Bot. 50, t. 19).—An erect, bushy plant, 10–12° high, with oval or subcylindric joints, bearing on short oval tubercles 3–5 large (1′ long) and many smaller spines, the larger ones loosely covered by glistening, whitish sheaths; purple flowers, small, 1 inch wide; fleshy, greenish berry, numerous small and very irregular seeds, or often abortive; wood a wide, fragile tube with short meshes.

Opuntia (Cylindropuntia) tessellata, Engelm.—Very bushy, from a stout trunk, with solid wood, sometimes several inches thick; ultimate branches as thick as a swan's quill, covered with angular, flattened, ashy-gray tubercles, the uppermost bearing at their upper end single, long, loosely yellow-sheathed spines; flowers small (about $\frac{3}{4}$ of an inch wide), yellow; small fruit, oval, covered with long, soft, brown bristles. Pac. R. Rep. *l. c.* t. 21.—On both sides of the Lower Colorado River, 6–7° high; the yellow, shining spines, crowded on the upper end of each year's growth, together with the scale-like tubercles, give the plant a singular and striking appearance.

There are several other cylindric *Opuntiæ* in Arizona, not collected in these Expeditions, and for the most part only imperfectly known. It is desired to direct attention to this interesting group, which, on account of the bulky forms and forbidding armament, are too much shunned by travellers.—*Opuntia echinocarpa*, Engelm. & Bigel., is a low and very spiny bush, with yellowish flowers and dry, spiny fruit. *Opuntia acanthocarpa*, Engelm. & Bigel, is taller, with elongated tubercles, or rather ridges, copper-colored flowers, and dry fruit bearing few, but stouter spines. *O. mamillata*, Schott, and *fulgida*, Engelm. & Bigel., are allied to *O. Bigelovii*, with thick tubercles or prominent crests, the former with small, the other with numerous long and shining, sheathed spines; fruit often abortive. Good specimens with flower, fruit, and good seed of the same plant (so that mixing species and forms may be avoided) are very desirable, as we know scarcely anything more about them than what the botanists of the Mexican Boundary Commission (often at the most unfavorable season) could find out, twenty-five years ago. *Opuntia leptocaulis*, DC. (*O. frutescens*, Engelm.), the most slender *Opuntia* known, bushy, with branches like pipe-stems, small yellow flowers, and red, somewhat fleshy berries, is common

from North Mexico, through Texas, to Arizona. It has been said that its flowers, contrary to the habit of the genus (which has diurnal flowers—*i. e.*, open in sunlight), are nocturnal, which, however, is now positively denied.

FICOIDEÆ.*

Mollugo verticillata, L.—Point of Mountains, Arizona (723).

UMBELLIFERÆ.

Eryngium Wrightii, Gray (Pl. Wright. 1, p. 78).—Erect, smooth, pale, somewhat branched; lower leaves narrowly spatulate, regularly pectinate or toothed, with each tooth terminating in a bristle; stem-leaves lanceolate, 3–5′ long, deeply cleft, with the divisions terminating in a bristle; upper leaves shorter, more deeply and palmately parted; petals blue, with a long, inflexed point; leaflets of the involucre longer than the head; inner bracts slightly exceeding the flowers.—Sanoita Valley, Arizona (603), at 6,500 feet altitude.

Musenium† trachyspermum, Nutt.—Branching from the base; radical leaves ascending, petioled, pinnately parted, with the segments pinnatifid; rachis broad, 1–2″; fruit nearly as broad as long, and slightly roughened; involucel of 8–10 leaflets, 2–4″ long, narrow, but slightly dilated upward.—Colorado (726).

Cicuta maculata, L.—Nevada and Utah.

Carum Gairdneri, Benth. & Hook.—Nevada, where, as in Utah, the tubers are an important article of food with the Indians.

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*Ficoideæ.—"A miscellaneous group, chiefly of fleshy or succulent plants, with mostly opposite leaves and no stipules; differing from *Caryophyllaceæ* and *Portulacaceæ* by having distinct partitions to the ovary and capsule (which are therefore 2–many-celled); the petals and stamens sometimes numerous in the manner of *Cactaceæ* (but the former wanting in most of the genera); agreeing with all these orders in the campylotropous or amphitropous seeds; the slender embryo curved partly or completely round a mealy albumen."—Fl. Cal. p. 250.

†Musenium, Nutt.—Calyx-teeth conspicuous. Petals clawed, obovate, point inflexed. Stylopodia small, depressed, styles rather short. Fruit ovate, slightly compressed on the side, commissure rather broad; carpels 5-angled, a little compressed on the back, with the primary ribs filiform, rather prominent, lateral ones contiguous. Vittæ many. Carpophore bifid. Seed compressed a little on the back, with the sides a little incurved.—Perennial, cæspitose herbs, branching from the base, smooth. Leaves pinnate or bipinnatifid, segments pinnatifid. Many-rayed umbel compound. Involucre none. Involucel of a few short leaflets. Flowers white or yellow.—Bentham & Hooker.

BERULA* ANGUSTIFOLIA, Koch. (*Sium angustifolium*, L.)—San Luis Valley, Colorado, *in hot springs*, the temperature of which is 80° Fahr., and in *spring* water at Fort Tejon, Cal., where the water has a temperature of 62° Fahr. In neither of these locations was there much of a yearly variation in temperature of the water, yet in one instance, as in the other, the plant grew luxuriantly, the difference in the temperature of the water at the two places being 18° Fahr. (732, 262.)

SIUM CICUTÆFOLIUM, Gmelin. (*Apium lineare*, Benth. & Hook.)—San Luis Valley, Colorado (730, 732).

CYMOPTERUS ALPINUS, Gray.—Low annual shoots 2–5′ high, from a perennial root; leaves bipinnatisect or bipinnate, segments 2–4″ long, linear, acutish, glabrous, or very minutely puberulent; scape as long as or exceeding the leaves; involucels 5–7-parted, segments linear or lanceolate, as long as the flowers; calyx-teeth conspicuous, subulate; fruit thickish winged, with the marginal ones a little wider than the others; vittæ *one in each interval and two on the commissure, all small.* Flowers small, yellow.—I have taken the character of this fruit from No. 213 of Hall and Harbour. The material, moreover, is very scanty. If, however, the specimen examined by me is fairly a representative one, the resemblance between it and *Œnanthe* is too obvious to escape attention, especially when we remember that with the other peculiarities it has no carpophore.—Griffith's Peak, near Georgetown, Colo., at 11,500 feet altitude (725, 731); also accredited by Porter to Mount Lincoln, Colorado, at an elevation of 13,000 feet.

CYMOPTERUS GLOMERATUS, Raf.—3–8′ high; caudex 1–2′ high, branching from the summit; peduncles shorter than the leaves; leaves ternately divided, deeply bipinnatifid, on long petioles, which are dilated at base. Umbels on very short rays; involucels palmately parted, unilateral and sometimes coherent with the rays of the umbellets; flowers white; fruit in my specimen, No. 210, of Hall and Harbour, with marginal wings thin and expanded and with the dorsal ones only a little less so. I must confess my

* BERULA, Koch.—Calyx-teeth minute. Stylopodium conical and styles short. Fruit nearly globose, with a broad commissure, emarginate at base, the ribs nerve-like, not raised above the thick epicarp; oil-tubes numerous and contiguous, surrounding the terete seed. Carpophore 2-parted, very slender.—A smooth, perennial aquatic; leaves pinnate and serrate; involucres and involucels of several leaflets; flowers white.—Fl. Cal., p. 260.

inability to find any trace of carpophore, either free or adherent, to the carpels.—Denver, where in June it is quite common on the plains.

LIGUSTICUM MONTANUM, Bentham & Hooker. (*Thaspium? montanum*, Gray.)—1–2° high, often branched; leaves twice ternately divided; lobes linear, linear-lanceolate, or lanceolate, 9–18″ long; petioles 1–4′ long, widely dilated into a sheath toward the base; fruit variable, oval or broadly oval, marginal wings broader than the others, or sometimes the dorsal as much dilated as the marginal; vittæ single or double in each interval; involucre none; involucels of 5–9 setaceous bracts, which are 2–4″ long; flowers bright yellow.—Central Colorado, reaching as high as 12,000 feet altitude (716, 719, 720, 724), and in Arizona, at Willow Spring, at 7,195 feet altitude (253). In the majority of cases in my specimens, one carpel has entirely, or almost entirely aborted.

LIGUSTICUM APIIFOLIUM, Benth. & Hook.—Twin Lakes, Colorado (717).

THASPIUM TRIFOLIATUM, Gray.—South Park, Colorado (727).

ANGELICA WHEELERI, Watson (American Naturalist, 7, 301).—"Tall and stout, roughly puberulent, leaves biternate; leaflets ovate-oblong, 2–3′ long, acute, incisely serrate, the teeth broad and mucronate, middle leaflets petiolulate; umbels naked; rays numerous, unequal, becoming 2–5′ long; pedicels and ovary hispid; petals apparently white; fruit broad-elliptical, 3″ long, sub-pubescent, the dorsal wings thick, narrower than the lateral ones, Utah."

ANGELICA LINEARILOBA, Gray (Proc. Amer. Acad. vii, p. 347).—Southern Sierra Nevada, at 9,500 feet altitude (355).

ARCHANGELICA GMELINI, DC.—Twin Lakes, Colorado (712).

FERULA MULTIFIDA, Gray (?).—From Utah, the Expedition has simply the leaves of what Mr. Watson doubtfully refers here.

PEUCEDANUM SATIVUM, Benth. & Hook. (*Pastinaca sativa*, L., Gray's Manual.)—Utah. Introduced.

HERACLEUM LANATUM, Michx.—Twin Lakes, Colorado (713), and New Mexico? Hance.

CORNACEÆ.

CORNUS PUBESCENS, Nutt.—Utah. A specimen from Loma, Colorado, is doubtfully placed here. Specimens too poor. (79.)

"GARRYA* FLAVESCENS, Watson (Am. Naturalist, 7, 301).—Silky-pubescent, with straight, appressed hairs; leaves yellowish, elliptic-oblong, acute at each end, 1–2½′ long, glabrate above, entire, revolute on the margin; petioles 3–6″ long; aments pendulous, the bracts broad-ovate, connate, foliaceous, acute or the lower ones acuminate, 6–10 pairs; sterile aments rather loose, 1–2 inches long, the flowers 1–3, on pedicels equalling or exceeding the ample bracts; fertile aments crowded, 1′ long, with solitary flowers and densely pubescent fruit.—From Southern Nevada and Utah to Arizona and New Mexico; growing 5–8° high."

CAPRIFOLIACEÆ.

ADOXA† MOSCHATELLINA, L.—Leaves mostly radical, 2–3′ long, ternately bi- or triternate, segments again trifid; flower-stems as long as, or longer than, the radical leaves, with a pair of trifid leaves. Head of about five greenish flowers terminating the stem, the terminal flower with fewer lobes to the calyx and corolla, and also fewer stamens than the lateral flowers. Berry green.—In shaded mountain ravines in Colorado, at 11,000 feet altitude.

SAMBUCUS GLAUCA, Nutt.—Willow Spring, Arizona (250); Utah.

SAMBUCUS MEXICANA, Presl.?—Camp Lowell, Ariz. (near Tucson); a small, much branched tree, 10° high and 5′ in diameter; bark light brown; young branches and petioles densely canescent; leaves on the under surface less so, nearly glabrous above; leaflets usually 5, 1½–3′ long, terminal one

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* GARRYA, Dougl. ex Lindl. Bot. Reg. t. 1686.—Flowers diœcious; aments between the united bracts *Male flowers*, with a 4-parted calyx, with the spreading linear segments valvate, apices sometimes cohering. Petals 0. Stamens 4, opposite or alternate to the sepals, filaments free; anthers fixed by the base, linear introrse or laterally dehiscent. Disk and rudiments of the ovary obscure. *Female flowers*, with the calyx-tube ovoid; lobes of the limb 2, opposite, short or obsolete. Rudiments of the stamens and disk 0. Ovary 1-celled; styles 2, filiform and erect, or short and recurved, longitudinally stigmatose within; ovules 2, hanging parallel from the apex of the cell; funiculus elongated. Berry ovoid, crowned by the persistent styles, 1–2-seeded. Seeds oblong, compressed, testa membranaceous, transversly rugose. Albumen copious, fleshy; embryo cylindrical, minute, cotyledons oblong, radicle terete.—Shrubs, with 4-angled branches. Leaves opposite, petioled, entire or denticulate, penninerved, evergreen, petioles connate at base. Flowers small, not articulated with the pedicel.—BENTH. & HOOK.

† ADOXA, Linn. Gen. n. 501.—Leaves ternately divided. Calyx with two or three spreading teeth or lobes. Corolla with a very short tube, and 4 or 5 spreading divisions. Stamens 8 or 10, in pairs, alternating with the divisions of the corolla, and inserted on a little ring at its base. Styles 3–5, very short, united at the base. Ovary 3–5-celled, with one ovule in each cell. Fruit a berry.—BENTHAM, Handbook of the British Flora.

generally the largest, oblong, irregularly serrate to within 6″ of the acute tip; inflorescence corymbose, "corymb 5-rayed"; stamens two-thirds as long as the petals; anthers oval or somewhat cordate. Fruit I have not seen. (712.)

SAMBUCUS RACEMOSA, L., var. PUBENS, Watson.—Clear Creek Cañon, Colorado.

SYMPHORICARPUS ROTUNDIFOLIUS, Gray (Pl. Wright. 2, 66).—"Leaves orbicular, or ovate-rotund, small and with the branches softly pubescent; flowers solitary in the axils; bracteoles shorter than the ovary, and with the teeth of the cup-shaped calyx ovate, obtuse and glabrous; corolla funnel-shaped, smooth within, lobes longer than the stamens. 3–4° high, much branched; leaves 5–9″ long and nearly as wide, entire or often repand, petiole a line or less in length."—Nevada. Not having access to the specimen, I quote the above original description bodily from Pl. Wright. In vol. v, King's Report, Mr. Watson places this under *S. montanus*, H. B. K. Later, however, he keeps them apart in his catalogue published by this Survey in 1874, p. 10.

SYMPHORICARPUS OREOPHILUS, Gray (Revis. Symph. Jour. Linn. Soc. vol. xiv, p. 12).—Low, branching shrub, with a loose, grayish epidermis; leaves oblong, obtuse, sessile or nearly so, thickish, somewhat glaucous below, entire or slightly undulate; principal veins below more or less pubescent, 6–12″ long and half as wide; inflorescence racemose along the short, lateral, leafy branchlets; flowers rising from the axils of the leaves on short pedicels, which are terminated by a pair of minute bracts one-fourth as long as the mature capsule; ovary oval, constricted under the persistent calyx-lobes, which are $\frac{1}{2}$″ long and very obtuse; corolla cylindrical, 4–6″ long, lobes $\frac{1}{2}$″ long, rounded, naked in the throat, but a little hairy inside toward the bottom; stamens included, on very short filaments rising just above the sinuses; anthers oblong, apiculate; stigma 2-lobed and one-third as long as the corolla-tube.—South Park, Colorado (18). Leaves smaller, but plant bearing a general resemblance to *S. racemosus*.

LINNÆA BOREALIS, Gronov.—Twin Lakes, Colorado, at 11,000 feet altitude.

LONICERA INVOLUCRATA, Banks.—Colorado (19).

RUBIACEÆ.

BOUVARDIA* HIRTELLA, H. B. K., var. QUATERNIFOLIA. (*B. quaternifolia*, DC., Prod. vol. iv, p. 365).—Low shrub, often much branched; older shoots clay-colored, younger dark green and puberulent; leaves short-petioled, thickish, lanceolate to broadly oval, acute, commonly three in a whorl, sometimes more, or again reduced to two, opposite, slightly hispid on upper surface, nearly glabrous on lower (except on the principal veins), and ciliate on the margin, 1–2′ long, 5–10″ wide; corymbs trichotomous. Corolla 12–18″ long, glandular puberulent, smooth or nearly so in the throat, lobes 1–2″ long; stamens sessile, oblong and slightly emarginate at base; calyx covered with a short, stiff, white pubescence, tube half as long as the acute, narrowly lanceolate lobes.—Camp Bowie, Ariz., at 5,500 feet altitude (478). I can find no description that exactly answers for this plant, yet it comes nearest to *Bouvardia quaternifolia*, DC., which, with *B. Jaquinii*, I am persuaded (from the description) are merely forms of *hirtella*. The species varies within wide limits.

MITRACARPIUM† BREVIFLORUM, Gray (Pl. Wright. 2, p. 68)—Annual, 4–8′ high, unbranched, slightly four-angled, nearly smooth; leaves 10–14″ long, 2–4″ wide, having between their bases a dense capitulum of small, white flowers; bracts bristle-like, very delicate; calyx-teeth unequal, the two longer twice as long as the calyx-tube, subulate, the two shorter very small; terminal head of flowers, according to Dr. Gray, is subtended by four leaves.—Sanoita Valley, Arizona (605).

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* BOUVARDIA, Salisb.—Flowers in clusters at the end of the branches. Calyx with 4 slender lobes. Corolla with a long and slender or somewhat trumpet-shaped tube and 4 short spreading lobes, valvate in the bud. Anthers 4, almost sessile in the throat. Style 1; stigma of 2 flat lips. Pod small, globular, 2-celled; seeds wing-margined.—GRAY, in Field, Forest, and Garden Botany.

† MITRACARPIUM, Zuccar.—Flowers hermaphrodite, capitate. Calyx-tube turbinate-obovoid, or sub-globose; teeth 4–5. Two often longer than the others, sometimes with smaller ones between, persistent. Corolla salver- or funnel-shaped, tube often encircled inside by a hairy ring; lobes of the limb 4, valvate, spreading. Stamens 4, inserted on the throat of the corolla; anthers fixed by the back. Disk fleshy. Ovary 2-, rarely 3-celled. Style with two shortish, linear branches; amphitropous ovules solitary in the cells. Fruit didymous, membranaceous, opening transversely at or below the middle, the upper part going with the calyx and exposing the seeds, the septa remaining in the other portion. Seeds oblong, globose, with the ventral face flat or 4-lobed; testa membranaceous, albumen dense, fleshy; cotyledons foliaceous.—Erect or prostrate herbs, root frequently perennial, branches 4-angled. Leaves opposite, linear-lanceolate or ovate, the upper ones often the longer, the setose, sheathing stipules connate with the petiole. Flowers in dense heads, minute, white, often intermixed with bristles.—BENTHAM & HOOKER.

GALIUM MICROPHYLLUM, Gray (Pl. Wright. 1, p. 80).—Smooth, ascending, ribbed stems, quadrangular, with obtuse angles; four linear-lanceolate leaves in a whorl, 3–5″ long, with distinct mid and marginal nerves, somewhat apiculate; peduncles axillary, one-flowered, or more frequently (in my specimens) proliferous from the involucre; fruit pruinose.—Tanks south of Camp Apache, Ariz. (271). A well-marked species.

GALIUM ASPERRIMUM, Gray.—(425), from Mount Graham, Arizona, appears to be a form of this, with the fruit minutely tuberculate.

GALIUM ASPERRIMUM, Gray? (Pl. Fendl. p. 60).—Mount Graham, Arizona, 9,000 feet altitude (425). Ovary in my specimens minutely tuberculate, rather than hairy. Mature fruit I have not seen. Indeed, I am not sure that the specimen may not prove to be *G. Aparine*, to which it appears closely related. If so, then it must be truly indigenous.

GALIUM TRIFIDUM, L.—San Luis Valley, Colorado (15, 16).

GALIUM BOREALE, L.—Common and variable, in Colorado (17); Utah

VALERIANACEÆ

PLECTRITIS CONGESTA, DC.—Nevada

VALERIANA DIOICA, L., var. SYLVATICA, Watson.—South Park, Colorado, at 10,000 feet (773).

VALERIANA EDULIS, Nutt (*V. ciliata*, T. & G.)—Radical or stem leaves may be entire or pinnately parted, or with any degree of division between. Valerian odor is very strong in this species on boiling.—South Park (774).

COMPOSITÆ.

STEVIA * CANESCENS, Benth.—Erect, 4–6° high, glabrous or puberulent below, rather roughly canescent above; leaves linear or oblanceolate, with smaller ones fascicled in their axils, serrate toward the apex, entire and

* STEVIA, Cav.—Flowers of the head all perfect and tubular. Involucre of 5-6 narrow, hard, subequal bracts. Receptacle flat, naked. Corollas equal, regular, slender; limb sometimes rather large, 5-cleft. Stamens appendiculate, obtuse at base. Branches of the style long, slender, and obtuse. Achenia linear, 4–5-angled. Pappus of two kinds, *i. e.*, small scales and bristle-like awns, one or both kinds present in the same flower.—Herbs or erect shrubs, not usually much branched. Leaves opposite, or the upper alternate, often 3-nerved and serrate, or sometimes 3-cleft or entire. Heads irregularly loosely paniculate or in a close corymb. Flowers white or purple, sometimes a little longer than the involucre. Achenia smooth or ciliolate on the angles.—BENTHAM & HOOKER.

gradually tapering to a petiole below; scales of the involucre rather hard, acute, with distinct midribs, roughly pubescent; pappus of short scales and 4–5 upwardly barbed awns; achenium linear, with five ciliolate angles. Corolla narrowly tubular.—Sanoita Valley, Arizona (607). So far as any mere description goes, this plant answers better to *S. serrata*, Cav. in Prod. v, p. 118, than to *canescens*. However, as it has been compared for me by Professor Gray, I cannot doubt it is correctly placed under the latter name. 732, from Mount Graham, Arizona, at an altitude of 9,000 feet, appears to be a distinct species (probably new), with broader, shorter leaves, less attenuated at base, with an expanded tube to the corolla, larger scales in the pappus, and red tips to the pappus awns. Lacking proper means of comparison, I provisionally refer it here.

EUPATORIUM BERLANDIERI, DC. (Gray, Bot. Mex. Bound. p. 76, where its affinities are discussed).—Herbaceous, 2° high, sub-puberulent below, puberulent above; leaves petioled, opposite, ovate or triangular-cordate, crenately serrate, 1–2′ long and half as wide; flowers about 20 in a head; pappus not larger than the corolla; achenium very slightly scabrous on the angles; scales of the involucre in two series, acute and ciliolate.—Sanoita Valley, Arizona (606).

EUPATORIUM PURPUREUM, L.—Utah.

BRICKELLIA (CLAVIGERA) LONGIFOLIA, Watson (Amer. Naturalist, 7, 301).—"Very slender, with spreading branches, glabrous, with a slight scabrousness; leaves linear, acuminate, 2–5 inches long, flat, entire or obscurely sinuate-toothed, rough-margined, 3-nerved, punctulate; flowers on short, slender pedicels, axillary, and in small, loose, terminal clusters; involucre glabrous, 2″ long, the scales acutish or the inner linear ones obtuse or truncate, spreading; achenium 10-striate, slightly and minutely hairy on the angles, nearly a line long; pappus soft, minutely barbulate, but little longer than the achenium.—Southern Nevada. Also collected at Kanab, Southern Utah, by Mrs. E. P. Thomson."—PLATE V. Branch, somewhat enlarged. Figure 1. A single head of flowers. 2. A single flower. 3. Style, enlarged about 15 diameters. 4. Receptacle and involucre. 5. Achenium and pappus. 6 A bristle of the pappus, enlarged about 20

diameters. Except where otherwise specified, the figures are enlarged about 10 diameters.

BRICKELLIA BETONICÆFOLIA, Gray (Pl. Wright. 2, 72).—Erect, covered with spreading, jointed hairs; leaves sessile, ovate, 3-nerved, crenate, hairy and somewhat glandular above and below, becoming smaller toward the top and gradually reduced to mere bracts; 2–4 heads of flowers on pedun-cles from the axils of the upper and opposite leaves; involucre in two or three series, all acute and ribbed, but the inner twice longer than the outer; pappus rough and achenium silky villose.—Arizona, Prof. Oscar Loew.

BRICKELLIA WRIGHTII, Gray (Pl. Wright. 2, 72).—Sub-shrubby, 4° high, much branched, glabrous or puberulent below, sub-scabrous and glandular above; leaves petioled, cordate, irregularly crenately toothed; veins prominent below; inflorescence thyrsoid-paniculate, each branch from the axil of a small leaf or branch; pedicels distinctly glandular hairy; heads about 15-flowered; corollas slender and styles much exserted; achenia hirto-puberulent; pappus roughish; scales of the involucre in about three series, purple-tipped, plainly nerved, obtuse.—Black River, south of Camp Apache, Ariz., at 5,000 feet elevation (793).

BRICKELLIA CALIFORNICA, Gray.—Nevada and Utah.

BRICKELLIA GRANDIFLORA, Nutt.—Colorado (422, 423).

LIATRIS SCARIOSA, Willd.—Dwarfed specimens from Trout Creek, Colorado (458).

XANTHOCEPHALUM* GYMNOSPERMOIDES, Benth. & Hook. (*Gutierrezia? gymnospermoides*, Gray, Pl. Wright. 2, 79.)—Smooth, erect, herbaceous, 2–3° high; leaves lanceolate, entire or nearly so, tapering into a petiole, slightly glistening with a gummy exudation, 2–3′ long, and about 6″ wide; heads in a compound corymb; rays many, rather small, without pappus; disk-flowers with a minute crown-like pappus of chaff, which in the central

*XANTHOCEPHALUM, Willd.—Heads heterogamous; flowers of the ray pistillate, numerous, about 1-seriate; disk-flowers perfect, fertile. Involucre hemispherical or broadly campanulate; bracts in many series, imbricated, coriaceous, with appressed or spreading tips, the outer ones smaller. Receptacle plane, foveolate. Pistillate corolla ligulate, sub-entire, spreading, elongated or small; perfect flowers regular, tubular; limb somewhat enlarged, 5-cleft at the apex. Anthers entire, obtuse at base. Style of the perfect flowers with flattened branches; appendages triangular or lanceolate. Achenia hardly compressed, smooth or striate. Pappus of minute chaff, coroniform or none.—Herbs or shrubs, with erect or ascending stems, often branching. Heads middle or large sized, solitary, on the end of the branches or loosely corymbose. Flowers all yellow. Achenia smooth.—BENTHAM & HOOKER.

flowers is sometimes produced into about six small, rigid bristles; involucre glutinous, with spreading tips; receptable flattish, alveolate. Separated from *Gutierrezia* by Bentham and Hooker on account of its numerous rays and coroniform pappus.—San Pedro River, Arizona (551), and old Camp Crittenden, Arizona (667).

GUTIERREZIA EUTHAMIÆ, T. & G.—(411, 412, 414, 415.) 410 is the same, verging toward *microcephala;* from Colorado, Arizona, New Mexico. Number 378 of the Sutton Hayes Collection appears in my herbarium under name of *G. microcephala*, and doubtless correctly, but it is so near some forms obtained by the Expedition that pass for *G. Euthamiæ* that one may well doubt the propriety of keeping them distinct.

GRINDELIA SQUARROSA, Dunal.—Colorado (Loew, 100). Utah.

GRINDELIA MICROCEPHALA, DC. (*G. inuloides*, Willd., var. *microcephala*, Gray, Bot. Mex. Bound, p. 81.)—Stems erect, smooth, branching somewhat; leaves thick, rigid, oblong, entire or slightly toothed toward the apex. Amplexicaule or sessile, inflorescence cymose(?); pappus (in my specimen) none in the ray-flower, and of only two awns in the disk; scales of the involucre almost always destitute of subulate tips, thick, oblong, and acute in several series, the inner of which are the larger; achenia flattened, four-angled, with corky angles, smooth.—Southern Arizona (796).

HETEROTHECA* SCABRA, DC.—Erect, much branching, somewhat rough, with long, spreading hairs arising from glandular bases; upper leaves rough, veiny, sessile or clasping, oblong or ovate, entire or toothed; lower ones petioled; inflorescence in a spreading panicle; achenia of the ray smooth, of the disk densely covered with appressed silky hairs.—Moist ground near Camp Lowell, Ariz. (703).

CHRYSOPSIS VILLOSA, Nutt.—From among the multitude of forms under

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*HETEROTHECA, Cass.—Heads heterogamous, radiate, with the rays in 1–2 series and pistillate; flowers of the disk perfect. Involucre hemispherical or broadly campanulate; bracts imbricated in many series, narrow margin subscarious, exterior ones smaller. Receptacle flat, alveolate, fimbrillate. Female flowers with ligulate, sub-entire corollas. Perfect flowers with regular, tubular corollas, somewhat enlarged above and 5-cleft. Anthers obtuse, entire, or a little emarginate at base. Branches of the styles of the perfect flowers flat, with long, narrow, or sometimes triangular and short appendages. Achenia flat, with a thickish margin and an obtuse apex. Pappus of the ray none, of the disk of an outer series of very short bristles, and an inner series of long scabrous bristles.—Erect, rough herbs, with alternate and often dentate leaves. Heads rather large, loosely paniculate or in a close corymb. Flowers all yellow. Achenia glabrous or silky villous. Pappus rusty-colored.—BENTHAM & HOOKER.

this species, I can recognize var. *hispida*, Gray, which is best marked, with its leaves lanceolate and acute, or spatulate, oblong and obtuse, from ¾–1′ long; plant hispid, with short, stiffish, and more or less dense hairs. (555, 464, from Colorado, 792 from Arizona, and an unnumbered one collected by Loew in New Mexico; var. *foliosa*, Watson, more leafy, with leaves obovate-spatulate, 1′ long, and more or less canescent, running into *C. canescens*, T. & G. (791, 182, from Arizona, and 552 from Colorado). Canescent form (724) from Southern Arizona is well marked.)

Var. Rutteri.—Stem erect, densely leafy; leaves 1–1½′ long, lanceolate, acute, densely covered with long, white, silky hairs; leaves gradually reduced to bracts under the involucre; ray-flowers ¾′ long, 1–1½″ wide.—Sanoita Valley, Arizona (662). This may be reduced to *C. villosa* var. *canescens*, which is apparently its nearest ally, yet it is quite different from any specimens of the latter that I have in my collection.

Aplopappus* Macronema, Gray (Proc. Amer. Acad. 6, p. 542).—Twin Lakes, Colorado, 9–10,000 feet altitude (451).

"Aplopappus cervinus, Watson (Amer. Naturalist, 7, p. 301).—Low (6 inches high), suffruticose, resinous-scabrous, the short herbaceous stems leafy to the top; leaves oblong-lanceolate, 4–6″ long, shortly cuspidate, attenuate to the base, entire, sub-scabrous, 3-nerved; heads 3–4″ long, in corymbs of 3–5, terminating the branches; outer involucral scales linear, acuminate, with setaceous, spreading tips, the inner chartaceous, acutish, with scarious, lacerated margins, erect, nearly equalling the pappus; rays few, narrow, and but little exceeding the disk; style exserted; achenia linear, pubescent.—Nearest to *A. suffruticosus*, Gray, Antelope Cañon." Utah.—Watson, *l. c.*—Plate VI. 1. Branch, natural size 2. Inner involucral scale. 3. Outer involucral scale. 4. Disk-flower. 5. Style and stigma. 6. Anther. All except the branch enlarged.

Aplopappus Fremontii, Gray (Jour. Bost. Nat. Hist. Soc. v. 5).—Glabrous, 1° high; corymbosely branched above, with the leafy branches

*Aplopappus, Cass.—Heads several- to many-flowered, heterogamous with fertile rays, or homogamous and destitute of rays. Involucre imbricated, in 2–several rows; scales with mostly acute and often somewhat spreading tips. Receptacle flat or nearly so, foveolate or alveolate. Appendages of the style usually elongated-subulate. Achenia variable in shape. Pappus simple, of copions, unequal, rigid, capillary bristles, which are more or less rough.—Herbs or under-shrubs, with yellow flowers, and pappus tawny or reddish, not often white.—(After Gray, Fl. Cal. vol. 1, p. 310.)

terminated by a rather large head; leaves oblong to linear-lanceolate, acute, sessile, coriaceous; scales of the involucre oblong, mucronate, in several series (inner ones much the longest), more or less ciliate; ray-flowers variable in length, but in my specimens one-third longer than the tawny pappus of the disk.—Loew, near Pueblo, Colo. (15).

Aplopappus Parryi, Gray.—Twin Lakes, Colorado (471).

Aploppapus Nuttallii, T. & G.—6′ high, from a woody base, more or less densely covered with a close, rather ashy pubescence; leaves obovate or lanceolate cuneate, thickish, serrate, the teeth tipped with long bristles; head smallish (3″ in diameter); rays none; disk-flowers 20–25, hardly as long as the fulvous pappus; scales of the involucre in about three series, thickish, rather obtuse, and with scarious margins.—Loew, Arizona (17 *a*).

Aplopappus gracilis, Gray.—10–18′ high; many wiry stems from the same root, sparsely covered throughout with long and delicate white hairs; small lower leaves pinnatifid, lobes rounded; upper leaves entire, narrowly linear, 3–6″ long; heads 3–5″ in diameter; scales of the involucre in several series, acute and somewhat mucronate or hairy tipped, half as long as the rays; receptacle deeply fimbrillate; bristles of the pappus distinctly unequal.—Sanoita Valley and Camp Apache, Southern Arizona (596); and var. *denudatus*, Torr., also from Arizona.

Aplopappus spinulosus, DC.—Much branched, from a woody base, softly puberulent or canescent; leaves pinnately parted, 6–18″ long, rather rigid; lobes again often variously divided, and tipped with a delicate bristle; involucre 4–6″ in diameter; scales in about four series, lanceolate, slightly mucronate or bristle-pointed; tawny pappus of the disk about equal to the flowers; rays 6–9″ long.—San Luis Valley, Colorado (470); and Santa Fé, N. Mex. (24).

Aplopappus lanceolatus, T. & G.—San Luis Valley, Colorado (474, 485). This form is in some features intermediate between *A. Vaseyi* and *A. tenuicaulis*, D. C. Eaton, and probably likely, according to Prof. Asa Gray, to destroy the latter species. See Watson's Botany of the 40th Parallel, p. 160.

Aplopappus inuloides, T. & G.—Low, and much branched, from a short stem, tomentose throughout or sometimes nearly glabrous; lower

leaves linear-lanceolate or lanceolate, tapering (usually) into long petioles, entire or irregularly and sharply serrulate, acute; upper leaves few, smaller and sessile; heads large, generally solitary; involucre mostly woolly (sometimes becoming glabrous when old); scales in about three series, lanceolate and rather obtuse; rays many and very variable in size and shape (in most of my specimens the rays are sterile); disk-flowers 2″ long; achenia fusiform, villous; pappus light brown.—Union Creek Pass, Colorado, at 10,000 to 11,000 feet (472, 579).

Aplopappus laricifolius, Gray (Pl. Wright. 2, p. 80).—Shrubby, low, resinous-dotted, much branched; branchlets short, leafy; leaves numerous, linear or nearly so, with a slight thickening upward, 5–8″ long; heads corymbose, terminating the branchlets; scales of the involucre in two series, acutish, with a brown midrib and scarious margin; rays 3–5 and 4″ long; disk-flowers 8–12; pappus soft, unequal and somewhat club-shaped; achenia distinctly villous.

This plant, from its general habit, clearly justifies Bentham and Hooker in retaining it with others under the old genus *Ericameria*, Nutt. Professor Gray, however, has indicated (Proc. Amer. Acad. viii, p. 635) that to do this involves at least two other genera in confusion.—Mount Turnbull, Arizona, Prof. Oscar Loew.

Bigelovia* Wrightii, Gray.—Woody at base, smooth or roughish, several thin stems rising from the base a foot or more high; leaves linear, obtuse, somewhat falcate, glistening from a resinous exudation, 6–18″ long; heads rather small; scales of the involucre coriaceous, obtuse and regularly imbricated in about four rows; disk-flowers 8–15, longer than the inner scales of the involucre; style-appendages shorter than the stigmatic part; achenia turbinate and hairy.—Arizona. Also the rougher var. *hirtello-scabra*, Gray, with smaller and less resinous leaves (*Linosyris Wrightii*, Gray, Pl. Wright. 1, p. 95).

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*"Bigelovia, DC.—Heads corymbose or cymose-clustered, rarely paniculate, 5–30-flowered, homogamous, the flowers being all perfect and with tubular corollas. Involucre imbricated; the scales dry, chartaceous or coriaceous, chiefly destitute of foliaceous or herbaceous tips. Receptacle flat, foveolate or alveolate-denticulate, rarely with a chaff-like projection in the centre. Appendages of the style-branches varying from ovate-lanceolate to subulate or filiform. Akenes narrow, terete or angular, slightly if at all compressed. Pappus simple, of copious unequal capillary bristles as in *Aplopappus*, or softer and more equal, tawny at maturity.—Herbs or under-shrubs, with narrow alternate leaves, and mostly small heads of yellow flowers, etc."—Gray, Fl. Cal. p. 314.

BIGELOVIA PARRYI, Gray.—Woody at base, 1° high, at first softly tomentose, at length nearly glabrous; leaves linear, 2–3′ long, 2″ wide; heads in a narrow thyrse, rather large; scales of the involucre loosely imbricated in about 3 series, *acutish, or with the tips sometimes attenuated*, about 12-flowered; teeth of the corolla rather large, tube puberulent; appendages of the style subulate or filiform.—Twin Lakes, Colorado, at 9,800 feet (453). (*Linosyris Parryi*, Gray, in Proc. Acad. Phila. 1863, p. 66.)

BIGELOVIA BIGELOVII, Gray.—Woody at and a little above the base, much branched from below; whole plant somewhat ash-colored; leaves filiform, revolute, more or less recurved and scattering; heads 4–6-flowered, in a raceme or slender panicle; scales of the involucre coriaceous, lanceolate, often acute or acuminate and in 4 or 5 series; pappus quite tawny, as long as the very slender flower; achenia smooth, linear, 4–6-angled, and with a broad epigynous disk; appendages of the style long and filiform, a little roughish under the lens.—Headwaters of the Arkansas in Colorado (454).

BIGELOVIA GRAVEOLENS, Gray. (*Linosyris graveolens* and *albicaulis*, T. & G. Fl. 2, p. 234.)—Colorado, New Mexico, Arizona, Nevada, and Utah; also var. *albicaulis*, Gray, obtained from Nevada.

BIGELOVIA DOUGLASII, Gray (*Linosyris viscidiflora*, T. & G.), var. SERRULATA, Gray; also var. TORTIFOLIA, Gray.—Twin Lakes, Colorado (413, 447). (478 is a broad-leaved form.)

SOLIDAGO CALIFORNICA, Nutt., var. ?—Stem simple, whole plant more or less densely covered with a short pubescence; leaves thickish, entire, oblong, 1–3′ long and 2–9″ wide; heads crowded into a dense, contracted panicle; scales of the involucre thickish, obtuse, and the outer puberulent; rays 6–8 (less numerous than the disk-flowers), large (2–3″ long); achenia pubescent.

This form (730) from Mount Graham, Arizona, and at an altitude of 9,000 feet, may prove a distinct species; believing, however, that its nearest affinity is as above indicated, I place it here for the present.

SOLIDAGO VIRGA-AUREA, Linn., var. HUMILIS, Gray.—(86 of Loew); (409, 404), from Colorado, and a specimen without number, collected by Loew from Mogollon Mesa in Arizona, 4,000 to 5,000 feet. Var. ALPINA, Bigel. (407), Half-Moon Creek, Colorado, at 12,000 feet altitude.

SOLIDAGO GUIRADONIS, Gray (Proc. Amer. Acad. vi, p. 543).—Nevada.

Solidago pumila, T. & G.—Stems several, from a woody procumbent caudex, 2–4′ long and leafy, angled, striate and nearly smooth; leaves rigid, mucronate, linear, or linear-lanceolate, 9–18″ long; heads few-flowered, clustered in 3 or 4, and disposed in a small corymb; scales of the involucre in several series, outer ones much shorter, rather acute, thickish; rays short and (like the disk-flowers) 2–4. Scales of the involucre appear (from my single specimen) to vary much in shape, acuteness, and thickness of the keel.—Eastern Arizona, at 6,500 feet, Loew.

Solidago nemoralis, Ait.—Twin Lakes, Colorado (408); also a variety from Nevada, Utah, and San Francisco Mountains, Arizona.

Solidago sparsiflora, Gray (Proc. Amer. Acad. xii, p. 58).—"*Virgaurea, Virgatæ:* Scabrous-puberulent; lower leaves unknown, upper ones and floral ones smallish, lanceolate (6–12″ long); racemes loosely few-headed and loosely thyrsoid; scales of the involucre linear, puberulent, at apex rather acute and greenish; ray-flowers about 10, ligules small; disk-flowers 4–5; achenia silky-pubescent.—Camp Lowell, Arizona." (706.)

Solidago mollis, Bartl. (*S. incana*, T. & G., var. *β.*?)—This rather remarkable form (782) from Arizona is canescent on the stem, 2–4° high; leaves decidedly scabrous, tripli-nerved, entire or sharply toothed toward the apex; head medium-sized and densely crowded in a contracted, secund panicle; scales of the involucre lanceolate, acute, and somewhat scarious on the margin, and with a darker midrib; achenia pubescent; branchlets of the panicle and the pedicels densely and softly tomentose.

Solidago Marshalli.—Erect, nearly smooth, or slightly pubescent in lines; leaves linear-lanceolate or lanceolate, entire, sessile, tapering toward either end; glandular dots and veinlets transparent by transmitted light, 1–4′ long and 2–7″ wide; panicle compound, and with the branchlets strongly secund; heads medium-sized, rays 8, disk-flowers 9; achenia short, cylindrical, hairy; scales of the involucre lanceolate or oblong, obtuse, thickish, and under the lens minutely roughened on the margin; pappus shorter than the disk-flower; bracts minute, almost subulate, about three on each of the slender smoothish pedicels.

It is evident that this plant is near to *S. odora*, Ait., but it appears to differ in its leaves and in the obtuse scales of the involucre, as well as in the larger number of flowers (of both kinds) in the head, and in the absence of the characteristic odor of *odora*. I name it in honor of Lieut. Wm. L. Marshall, United States Engineers, for whose assistance in my work I am under many obligations.—Chiricahua Agency, Southern Arizona (530).

SOLIDAGO MISSOURIENSIS, Nutt.—Twin Lakes, Colorado (405).

SOLIDAGO CANADENSIS, L. (var.?)—This form has been placed here by Dr. Gray. It is, however, nearly perfectly smooth, or at most only puberulent below and slightly pubescent above; leaves also are barely roughish above and glabrous below.—Twin Lakes, Colorado (406).

APHANOSTEPHUS * RAMOSISSIMUS, DC.—Stems much branched from a woody base, nearly glabrous, puberulent, or somewhat hispidly pubescent at tip; lower leaves narrowly spatulate or oblanceolate, variously toothed or divided at the apex, closely sessile, 1–2′ long, 1–3″ wide; upper leaves narrower, more entire and pubescent or hispidly pubescent; heads 3″ in diameter; involucre-scales in two series, oblong, rather acute and pubescent, the apices and margins distinctly scarious; rays 2–4″ long, narrow, at first a little pinkish and afterward yellowish or white; disk-flowers yellow, hardly longer than the scales of the involucre (in my specimens, there is no evident thickening of the tube of the disk-flowers); pappus coroniform, of very short bristles; achenia obscurely angled, many-ribbed (most distinctly so on the inner side), and with a few rather long hairs.—My specimens (336) from the Gila River, in Arizona (2,800 feet altitude), show considerable range of variation in shape of leaves, acuteness of involucral scales, and degree of pubescence.

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* APHANOSTEPHUS, DC.—Heads heterogamous, radiate; ray-flowers fertile; disk-flowers perfect. Involucre hemispherical, the linear or lanceolate bracts imbricated in a few series, their apices and margins scarious [slightly], exterior ones somewhat shorter. Receptacle convex. Rays narrow, spreading and entire; disk-flowers tubular, the limb elongated, slightly enlarged, 5-toothed. Anthers entire and obtuse at the base. Branches of the style in the perfect flowers compressed, terminated by very short, obtuse appendages. Achenia subterete or obtusely 4–5-angled, many-ribbed. Pappus coroniform dentate, sometimes short.—Much branched, erect or ascending, canescently puberulent herbs. Heads solitary on the dilated apices of the branches. Rays white; disk yellow. Achenia smooth.—BENTHAM & HOOKER.

TOWNSENDIA* ROTHROCKII, Gray,† in herb.—Perennial, stemless; leaves narrowly spatulate, narrowed into a petiole as long as the blade, both together 1′ long; blade thickish, entire, smooth; petiole expanded toward its insertion, and with a few silky hairs; heads sessile, 1′ in diameter, obtuse scales of the involucre in 3–4 series, oblong or narrowly oval, purplish, thickish, margins distinctly ciliate, or toward the apex sometimes slightly fimbriate lacerate; rays fertile, blue or purplish, exceeding the disk by one-half, 1–1½″ wide, entire or toothed; pappus somewhat united at base, squamellate-subulate, one-fourth as long as the tube, with one or two bristles exceeding the others; disk-flowers yellow, about as long as the rather unequal pappus; achenia rather hairy, oblong, flattened. Heads one or more from the same caudex. Apparently a somewhat variable species, but sufficiently distinct from *T. sericea*, to which it most nearly approaches by the obtuser scales to the involucre, the shorter and broader rays, and the short pappus of the ray-flowers. It will hence be observed that it approaches *Nanastrum*, though kept distinct by its perennial root.—South Park, Colorado, at 13,500 feet (875). (Also either 418 or 417 of the already distributed sets, but from a mixing of labels I cannot determine which.)—PLATE VII, A. Natural size. 1 Inner involucral scale. 2. Ray-flowers. 3. Ray-style and stigma. 4. Portion of ray-pappus, magnified about 25 diameters. 5. Disk-flower. 6. Cross-section of achenium. 7. Style and stigma of disk-flower. 8. Bristle from ray-pappus. All enlarged about 10 diameters, except where otherwise specified.

TOWNSENDIA SERICEA, Hook.—Resembling the above in general habit, but differing in having silky-canescent and narrower leaves, acute scales to the involucre, longer and narrower rays, and a longer pappus to the ray-flowers.—Colorado (419), at Kit Carson (on the plains), and also a var. with shorter rays and more hairy and narrower leaves at Georgetown, among the mountains.

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* TOWNSENDIA, Hook.—Heads radiate; rays fertile; disk-flowers perfect or sometimes [both ?] infertile. Involucre hemispherical or broadly campanulate, the lanceolate bracts imbricated in a few series, the exterior smaller, margins scarious. Receptacle plane, naked or fimbrillate. Rays longer than the involucre, entire or toothed; disk-flowers regular, tubular, the limb narrowly campanulate or a little dilated with 5 short teeth. Anthers at base obtuse, entire. Branches of the style in the disk-flowers flattened, with lanceolate appendages. Disk-achenia compressed, those of the ray 3-angled, the scabrous or barbellate pappus rigid, unequal.—Low perennial or annual herbs, more or less canescent.—Rocky Mountain Region between the Saskatchewan and New Mexico.—BENTHAM & HOOKER.

† Dr. Gray has indicated *T. scapigera*, D. C. Eaton, as the nearest relative of this species.

TOWNSENDIA STRIGOSA, Nutt.—Valley of the Upper Arkansas, Colorado (517, 853).

TOWNSENDIA SCAPIGERA, D. C. Eaton (Vol. V of Fortieth Parallel Survey, p. 145, pl. xvii, figs. 1–7).—Nevada.

ASTER TANACETIFOLIUS, H. B. K. (*Machæranthera tanacetifolia*, Nees.)—Biennial, erect, 6′–2° high, usually much branched, pubescent or viscid, or sometimes nearly glabrous; leaves once to three times pinnatifid, the divisions bristle-tipped; involucre hemispherical, 3–8″ in diameter; scales imbricated in several series, lanceolate or linear, always acute, and sometimes with very long, tapering, herbaceous tips; rays about 25, violet, twice as long as the disk-flowers; achenia with two strong marginal ribs, and several on either face, very villous; mature pappus reddish.—Colorado (854, 491, 505, 19). Also from Arizona and New Mexico.

ASTER CANESCENS, Pursh. (*Machæranthera canescens*, Gray; also Eaton in Bot. King.)—Very variable, and obtained by the Expedition from Colorado, Arizona, New Mexico, Nevada, and Utah.

ASTER COLORADOENSIS, Gray. (Proc. Amer. Acad. xi, 76.)—420 and 455 of the Colorado collection, in which it was distributed as *Machæranthera canescens*. Stems 2–4′ high, several from the same root, each terminated by a single head, tomentose or canescent; leaves coriaceous, the lowest spatulate, the upper lanceolate or linear, all sharply serrate, having the teeth bristle-pointed; involucre hemispherical, the acute herbaceous-tipped scales narrowly lanceolate, canescent, and in 2–3 series; rays 35–40, large, bright purple; achenia ribbed, turbinate, and densely canescent or villose; pappus rusty-colored.

Prof. T. C. Porter raises the question as to whether this may not be *Dieteria pulverulenta*, Nutt. I have not access to authentic specimens of this; but there certainly are many strong resemblances from the description in Flora of North America by Torrey and Gray. See vol. 2, p. 101. Unlike the others of the same section, this (*Aster Coloradoensis*) is perennial.—PLATE VII, B. Natural size. 9. Ray-flower. 10. Ray-flower style and stigma. 11. Disk-flower. 12. Disk-flower style and stigma. 13. Achenium and pappus of disk-flower. About 10 diameters.

ASTER ADSCENDENS, Lindl.—Twin Lakes, Colorado, at 10,000 feet (522); also from Utah. Var. CILIATIFOLIUS, T. & G., stems with many linear leaves (1–3′ long and 1–3″ wide), somewhat ciliate; scales of the involucre ciliate, acutish; upper part of the stems rather hispidly pubescent.—Cottonwood Creek, Colorado (524). The leaves are in the main narrower and the scales of the involucre less acute than in 252 of Hall and Harbour's collection, with which my 509 more nearly compares. Number 492 of our Colorado collection is a slender, almost leafless state, with smaller rays and more acute tips to the involucre than the typical var. *ciliatifolius*. 523 approaches *A. falcatus*, Lindl. Number 525, marked by Dr. Gray as a curious form, is, except for its smooth involucral scales, very much like *A. integrifolius*, Nutt. (No. 6166 of Bolander's California collection), and so like the description of *A. adscendens*, var. *Parryi*, Eaton, that I am constrained to leave it there, and hence will probably be *A. adscendens*, Lindl. (?) (as considered by Dr. Gray in Fl. Cal. 1, 324); from Colorado. A specimen of *adscendens*, however, collected by me at the Soda Spring, on Kern River, in California, is like 525 in the involucral scales, but with much narrower leaves. Except this one from California and the one from Utah, all my material is from Colorado, at or above 10,000 feet altitude.

ASTER NUTTALLII, T. & G. Fl. 2, p. 126; var. FENDLERI, Torr. (*A. Fendleri*, Gray, Pl. Fendl. p. 66).—In the absence of the plant, I subjoin the following original description of Dr. Gray, entire, from Pl. Fendl.: "Span high, with many ascending, rigid, somewhat hispid stems from a subligneous root; branches monocephalous, corymbose-paniculate; leaves small, rigid, entire, linear, coriaceous, sessile, mucronulate, smooth and single-nerved, with the margins hispidly ciliate; the lowest subspathulate, and the upper very short; involucre campanulate, scales in 3 series, linear-oblong, glandulose-scabrellate, mucronulate, the exterior herbaceous ones obtuse and lax, the interior a little longer, acute; achenia pubescent." (510.)

ASTER FALCATUS, Lindl.—Valley of the Upper Arkansas, Colorado, and San Francisco Mountains, Arizona (488, 501).

ASTER SIMPLEX, Willd.—Nevada.

ASTER MULTIFLORUS, L., var. *γ*. COMMUTATUS, T. & G.—Stem slender, unbranched, nearly sessile, 3–4″ in diameter; scales of the involucre

oblong-spatulate, thickish, roughish-pubescent. Leaves 6″ long and 1–2″ wide, with fascicles of smaller ones in their axils.—Arizona coll., Oscar Loew. The Expedition has also a variety from Utah, which I have not seen.

ASTER GLACIALIS, Nutt.—Utah.

ASTER ELEGANS, T. & G., var. ENGELMANNI, D. C. Eaton. (*Aster Engelmanni*, Gray.)—Utah.

ASTER DOUGLASII, Lindl. ?—San Luis Valley, Colorado (500). Scales of the involucre narrowly lanceolate, very acute, with a narrow chartaceous margin; leaves 2–4′ long, 2–5″ wide, with the margins distinctly hispidly ciliate.

ASTER SALSUGINOSUS, Richards.—(486, 520, 516, 504.) From Colorado, and all good representatives of the species. Number 521, however, differs widely in appearance, both in the dried and living states, from the others, and might even by many be regarded as a distinct species compared with 516 and 520. It is shorter, much more leafy, with the scales of the involucre oblong, obtuse, and almost smooth, except on the ciliate margins; the rays are wider, shorter, and more deep purple, to say nothing of its having a broader and smoother achenium. I do not, however, regard it as even a good variety, for all (516, 520, and 521) were obtained from a single clump in a cool, shady location at 11,300 feet, on Union Creek Pass, in Colorado.

ASTER PAUCIFLORUS, Nutt.—Stem erect, simple, 1–2° high, smooth below, puberulent or viscidly puberulent above; stem-leaves linear, 2–6′ long, 1–2″ wide, indistinctly 3-nerved; entire margins thickish and smooth, becoming gradually reduced to subulate bracts above; heads few, terminating the branches, 3–5″ in diameter; scales of the involucre in about three series, acutish, viscidly puberulent; rays purple, twice as long as the disk-flowers; pappus light-colored, almost in a single series and nearly as long as the disk-flowers.—San Luis Valley, Colorado (508).

ASTER SPINOSUS, Benth.—Stem much branched, glabrous, striate, subangular above and terete below; leaves few, scattered, and reduced to subulate scales, 1–3″ long; heads solitary (rarely racemose), terminating the branches; scales of the involucre not longer than the disk, in three series, acute, and with scarious margins; achenia glabrous.—A most peculiar-looking plant extending across the southern part of the continent, from Texas to California; Southern Arizona (769).

ASTER*. ERICÆFOLIUS, Rothrock (in Botanical Gazette, Jan., 1877).—Willow Spring, Arizona (208); Santa Fé, N. Mex. (14).

ERIGERON CANADENSE, L.—Central Arizona (718, 764).

ERIGERON COMPOSITUM, Pursh—Colorado (493); also var. *discoideus*, Gray, from Utah. Number 496 from Colorado is a form near *E. pedatum*, Nutt., but still somewhat hirsute, and the leaves and petioles distinctly hispidly ciliate, and the involucre as hairy as the typical *E. compositum*.

ERIGERON GRANDIFLORUM, Hook., var. ELATIUS, Gray (Enum. Pl. Parry).—A foot or more high, with several heads; stems leafy almost to the summit; scales of the involucre with extremely delicate tips, and united into a woolly mass.—Mosquito Pass, Colorado (487, 490).

ERIGERON URSINUM, D. C. Eaton (in vol. V, King's Survey, p. 148).—(495.)

ERIGERON UNIFLORUM, L., var.—4–10′ high, more or less pubescent, a single head terminating the erect, sparsely leaved stem; lower leaves spatulate-oblong, tapering to a hispidly ciliate petiole; stem-leaves oblanceolate, sessile; scales of the involucre somewhat crowded, hairy, and usually with purple, tapering tips; rays about 60, purple, twice as long as the disk-flowers (achenia too young); pappus almost uniform and a little shorter

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* "DIPLOPAPPUS ERICOIDES, T. & G.—To save labor to some others who, like myself, work under the double disadvantage of a rather limited library and an herbarium (rich enough in the later new species) with but few specimens from the original sets made prior to 1862, I put the following in print. From our present standpoint it is evident that *Diplopappus* as formerly understood must be partitioned out among other neighboring genera, and of the species that concern us here, one goes to section ERICAMERIA of *Aplopappus*, and the other to section ORTHOMERIS of *Aster*. In the unavoidable changing of names a confusion arises under the name above given, i. e., *Diplopappus ericoides*, there being two plants that bear the name in herbaria and books. The following may in some sense clear up the matter:

Diplopappus ericoides, T. & G. *Eucephalus ericoides*, Nutt. "*Inula? ericoides*, Torr.! in Ann. Lyc. New York, 2, p. 212. *Chrysopsis ericoides*, Eaton, Man. Bot."

Now placed in *Aster* under Sect. ORTHOMERIS. As the name *ericoides* is preoccupied in this genus I suggest for it *Aster ericæfolius*, which indicates even more closely its general habit.

See also *Diplopappus ericoides*, T. & G., Vol. V., King's Report; Pl. Wright., p. 78; Pl. Fendl., p. 69; Bot. Mex. Bound., p. 78.

Diplopappus ericoides, Less. *Aplopappus ericoides*, DC., and apparently also of Hooker and Arnott. See DC., Prod. V., p. 278; Bot. Beechy, p. 146; and Fl. Cal. I., p. 313.

In the last, *Ericameria microphylla*, Nutt., is also cited as another name for the same, and by this it appears in Flora of North America, T. & G., 2, p. 236.

The two plants are so different in habit,—the one suggestive of (so far as arrangement of the foliage goes) *Erica*, and the other of *Adenostoma fasciculatum*, Hook. & Arn., or of *Eriogonum fasciculatum*, Benth.—as well as in habitat, that any further description is unnecessary."—Botanical Gazette, January, 1877.

than the disk-flowers.—Alpine summits of Colorado (515, 494). Near to *Erigeron glandulosum*, Porter.

ERIGERON ARMERIÆFOLIUM,* Turcz. (*E. lonchophyllum*, Hook. in Bot. King's Exped.)—4–8′ high; many stems from a single root; entire plant hispidly pilose; root-leaves narrowly oblanceolate, tapering into long, slender petioles; stem-leaves sessile, linear; inflorescence corymbose or racemose, with a single head terminating a branch; scales of the involucre lax, hardly in two series, acute, and the purple tips often taper-pointed; achenia cylindrical, hairy; pappus with few or no smaller bristles intermixed; rays very narrow, longer than the involucre.—Twin Lakes, Colorado (527).

ERIGERON BELLIDIASTRUM, Nutt.—Like the following, except "in having a simple and wholly deciduous pappus, and its achenium is tipped with a broad and white epigynous disk." See Gray, in Proc. Amer. Acad. vol. viii, 648.—Sierra Blanca, Arizona, at 9,000 feet (811).

ERIGERON DIVERGENS, T. & G. (*E. Bellidiastrum*, Nutt, D. C. Eaton in Bot. King's Exped.) *Vid.* Gray, *l. c.*—Camp Grant (383), Arizona, and from the Zuñi Villages, New Mexico (169), where it is probably *E. cinereum*, Gray, Pl. Fendl. From McArthy's Ranch in New Mexico we have (100) a typical *E. divergens.*

ERIGERON FLAGELLARE, Gray (Pl. Fendl. p. 68).—Perennial, 6–10′ high, many slender stems arising from the same root; whole plant strigulose puberulent; lowest leaves spatulate or oblanceolate, narrowed to a petiole; upper leaves linear, sessile, 4–7″ long; heads terminating the erect branches, which are naked near the summit; scales of the involucre linear, acute, with scarious margins; ligules slender, very numerous, white or slightly rose-colored; pappus in (both ray- and disk-flowers) two series, the exterior short, squamellate, the interior longer.—A well-marked species, readily recognized at sight by its horizontal, flowerless stolons. Apex, Colorado (518), and Santa Fé Creek (25), whence doubtless it was first taken by Mr. Fendler.

ERIGERON DELPHINIFOLIUM, Willd. (*Polyactidium delphinifolium*, DC. Prod. v, 281–282.)—Perennial, with many erect, leafy, slender stems from the same root, hispidly pubescent; lower leaves pinnately parted or

* See Gray, Fl. Cal. 1, p. 326.

divided, tapering into a petiole; divisions linear or oblong, or sometimes the upper leaves entire, sessile; stems branching toward the summit, a single head terminating each branch; scales of the involucre in about three series, linear, acute, and with scarious margins; rays white, in about two series, fertile; disk-flowers perfect, in both the short coroniform pappus distinctly marked, with a few longer bristles intermixed; achenium with a distinct epigynous disk, somewhat flattened (sometimes with distinct marginal and facial ribs, as in *Machæranthera*).—Mount Graham, Arizona, at 9,000 feet altitude (731). Number 500, from Camp Bowie, Ariz., appears to be the canescently hirsute variety alluded to in Botany of Mexican Boundary, p. 78. In my specimen, the leaves are also much more finely divided toward the summit (to say nothing of some difference in the achenia) than in the typical form. I think this might be safely regarded as a distinct species.

ERIGERON PUMILUM, Nutt.—Denver, Colo. (514).

ERIGERON MACRANTHUM, Nutt.—Mount Graham, Arizona, at 9,000 feet altitude (736); also from Utah.

ERIGERON COULTERI, Porter.—In absence of sufficient material, I am obliged to quote the following good description of Professor Porter (Fl. Colorado, p. 61): "Stem simple, from a slender root, 6–12′ high, bearing a single head, smooth below, pilose-pubescent above, leafy to the top; leaves thinnish, pubescent, with ciliate margins, all more or less serrate-denticulate, mucronate, erect, gradually diminishing in size upward; lower ones oblong-spatulate or elliptical, tapering into a margined, ciliate petiole, upper ones oblong or lanceolate, acute or acuminate, sessile, and partly clasping; head large 1–2′ broad, including the numerous white rays; involucre about 9″ broad, hemispherical, densely pilose, but scarcely woolly; scales lance-linear, with scarious margins, tips elongated, subulate, spreading, glandular; achenia pubescent; bristles of the pappus minutely scabrous, outer ones short and few; alveoli of the receptacle rough with lacerate margins." In my specimen, the plant is almost glabrous throughout, except the scales of the involucre, and the leaves are barely denticulate; flower also was purplish. In my preliminary report, I published this (519) as "*E. macranthum* verging toward *grandiflorum*".—Union Creek Pass, Colorado, at 11,300 feet altitude.

ERIGERON SPECIOSUM, DC.—Stem erect, glabrous or nearly so, 1–2° high, strongly furrowed, branching; entire stem leafy, branched above; radical leaves spatulate, petioled, those of the stem sessile, acuminate, slightly ciliate; inflorescence corymbose; scales of the involucre in two or three series, crowded, linear, much attenuated at the tip, hirsute, and with scarious margins; rays over a hundred, narrow, purple; achenia slightly hairy, distinctly ribbed; outer pappus present, but not evident.—Western New Mexico, Loew. As this species would here appear to be much out of its range, it may not be out of place for me to state I have compared the specimen with authentic specimens taken from the Cambridge Botanic Garden, and find them the same throughout.

ERIGERON CÆSPITOSUM, Nutt.—San Francisco Mountains, Arizona, and Utah.

CONYZA* COULTERI, Gray.—Softly pubescent and very slightly viscid, erect, somewhat branched at summit, 6′–2° high, leafy to the top; leaves linear or linear-oblong, sessile, somewhat clasping (or the lower spatulate), entire or irregularly pinnatifid or toothed; panicle close and crowded; heads small, 2″ long; scales of the involucre lanceolate, acute, with scarious margins and a green middle.—Mount Graham, Arizona, at 9,000 feet (743), where it is extremely common on the more open grounds, and strikingly suggestive, in habit, of *Erigeron Canadense* elsewhere.

BACCHARIS† CÆRULESCENS, DC.—Shrubby at base, 6–8° high; branches slender; younger shoots and leaves smooth; leaves lanceolate, acute, irregularly sinuate-dentate, tapering to a short petiole, 3–7′ long and 4–7″ wide; inflorescence in a loose paniculate corymb; each head on a slender pedicel with a small subulate bract at base; scales of involucre ovate, with a

* "CONYZA Linn.—Heads many-flowered, heterogamous, but not radiate; the pistillate flowers in many series and more numerous than the fertile ones, with only a filiform truncate corolla shorter than the style; the few central flowers tubular and perfect, or some of them infertile. Involucre of narrow numerous scales. Receptacle flat or convex, naked. Style-appendages short. Achenes flattened, usually nerved only on the margins. Pappus as in *Erigeron*, in ours of simple scanty capillary bristles," etc.—GRAY, in Fl. Cal. 1, p. 332.

†BACCHARIS, Linn.—Homogamous, diœcious. The sterile flowers with a perfect style, but an abortive ovary; style sometimes undivided; corolla tubular and pappus shorter and more tortuous. Fertile flowers pistillate only, corolla filiform and truncate. Achenia terete or somewhat compressed, ribbed. Heads many-flowered; scales of the involucre dry, in several series, the outer ones shorter; receptacle flat or flattish.—Herbaceous or low shrubby plants, with alternate leaves and dull-colored inconspicuous (somewhat conspicuous in *B. Wrightii*, Gray) flowers.

delicate scarious margin; fertile flower with the style and stigma projecting one-fourth its length beyond the truncate, filiform corolla, the copious pappus reaching to the tip of the stigmas; achenia narrowly cylindrical, smooth, covered with minute papillæ: sterile flowers with a less copious pappus and the tube dilated upwardly, deeply cleft.—Southern Arizona, at about 5,000 feet altitude (580, 447).

Baccharis salicina, T. & G.—Shrubby at base, erect, 6–8° high, smooth; leaves lanceolate, usually obtuse, entire or irregularly dentate, tapering to a petiole; inflorescence in a compound corymb; heads sessile or with a very short pedicel; scales of the involucre obtuse, broadly ovate, with scarious sub-fimbrillate margins; fertile flowers having a silky pappus twice as long as the truncate flower and its exserted stigma; achenia smooth, cylindrical, with many ribs; receptacle with distinctly fimbrillate alveoli; sterile flowers having less copious pappus and a rather slender tube; flower deeply cleft.—Southern Arizona and New Mexico (771); also from San Luis Valley, Colorado (456); Nevada.

Baccharis halimifolia, L.—Nevada and Arizona.

Baccharis Wrightii, Gray (Pl. Wright. 1, p. 101).—Herbaceous, glabrous, 1–2° high, diffusely branched from the base, the branches somewhat flexuose and angular-striate; lower leaves spatulate, 4″ long, upper gradually reduced; fertile flowers with lanceolate acute scales to involucre, the margins of which are scarious and the middle green; pappus tawny, 9″ long; achenia 2″ long, terete, plainly ribbed and with transverse rugosities between the ribs. I have not seen the sterile plant; a good description of it is found where the plant was first described.—Central New Mexico at 6,000 feet altitude (93).

Baccharis Emoryi, Gray (Bot. Mex. Bound, p. 83).—Shrubby, much branched, with the branches sharply ribbed and angular; leaves few, obtuse, linear, 2–7″ long; heads small, terminal; scales of the involucre in 4–5 series, the outer ones ovate, obtuse, with finely denticulate scarious margins, the inner ones nearly twice as long, linear and acutish; fertile flower with copious white or light-brown pappus, which is 3–5″ long; achenia less than a line long; sterile flower with tube gradually dilated upward; pappus of a few bristles, some of which are distinctly clavate.—Arizona.

Baccharis sergiloides, Gray, *l. c.*—Much branched and nearly leafless shrub; branchlets green, jointed; older branches brown; leaves oblanceolate or nearly linear, 3–8″ long, or reduced to mere scales; heads panicled; scales ovate, thickish, with a green tip (or sometimes the inner ones linear); achenia few-nerved. The young green branchlets are often more or less covered with a glistening, gummy exudation. As in the preceding (*B. Emoryi*), the pappus of the sterile flower is clavate, though here it is more copious.

Pluchea camphorata, DC.—Telescope Mountain, Southeastern California.

Tessaria borealis, T. & G.—Nevada.

Gnaphalium palustre, Nutt.—San Luis Valley, Colorado (426, 428).

Gnaphalium Sprengelii, Hook. & Arn. (*G. luteo-album*, var. *Sprengelii*, in vol. v of King's Report.)—Cottonwood, Arizona (356); also from Utah.

Gnaphalium strictum, Gray.—Annual (?), simple or much branched from the root, canescently woolly throughout; leaves linear, 6–18″ long; heads condensed into woolly glomerules, and one in each axil, forming thus an interrupted spike; outer involucral scales obtuse, rather ovate, as long as the disk-flowers, inner longer, narrower, and more acute; achenia oblong, smooth.—San Luis Valley, Colorado (425, 427), and a depauperate form from Twin Lakes, Colorado (423).

Antennaria dioica, Gaertn.—Colorado (444, 443, 436); common. The Survey has also the var. *rosea* from Nevada.

Antennaria Carpathica, R. Br.—South Park, Colorado (208, 433, 434).

Anaphalis* margaritacea, Benth. (*Antennaria margaritacea*, R. Br.)—Collected by Dr Oscar Loew on the White Mountains of Arizona, probably at a considerable altitude.

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* Anaphalis, DC.—"Heads discoid, incompletely dicœcious; viz. the pistillate with filiform, 2-4-toothed corollas very numerous, and a few (or occasionally no) hermaphrodite but sterile flowers, with tubular 5-lobed corollas in the centre; the staminate nearly as in Antennaria. Involucre campanulate, of many ranks, of mostly snow-white scarious scales. Receptacle flat, naked. Style in the staminate flowers usually 2-cleft merely at the apex. Pappus a single series of capillary bristles, unconnected at base, in the sterile flowers (at least in our species) slightly thickened upwards."—Gray, in Fl. Cal. 1, p. 340; see, also, Gray in Proc. Amer. Acad. viii, p. 653.

MELAMPODIUM* CINEREUM, DC.—Woody at base, 4–12′ high, simple or much branched, covered with a short silky pubescence; leaves numerous, linear or slightly linear-spatulate; rays white (about 8), emarginate, oblong or lanceolate.—A common plant in the drier parts of New Mexico and Arizona (96, 327).

BERLANDIERA† LYRATA, Benth.—Erect, branching at base; radical leaves lyrate on long petioles; terminal segment much the largest and (as well as the others) irregularly toothed; upper leaves lyrate but sessile; rays 6–8, orange, with darker veins, emarginate, tomentose outside and especially on the veins. Whole plant is softly tomentose.—Covero, N. Mex. (98).

PARTHENIUM INCANUM, H. B. K.—Suffrutescent and much branched; younger branches and leaves canescently tomentose; leaves clustered, oblong, deeply cleft or pinnate, 5–8-parted; divisions obtuse, 9–15″ long and 3–6″ wide, ashy color from the dense, short pubescence; inflorescence corymbose-paniculate; involucral scales in two series, outer oblong, inner broadly oval or nearly round and scarious with a ciliate-fringed margin; rays short, ligules obcordate; achenia flattened obovate and with a pappus of two short, persistent awns; disk-flowers shorter than the obovate, hyaline, ciliate-fringed scales which enclose them.—Camp Bowie, Southeastern Arizona (453).

HYMENOCLEA MONOGYRA, T. & G.—Arizona (778).

AMBROSIA PSILOSTACHYA, DC.—Utah, and (529, 697) Arizona.

AMBROSIA APTERA, DC.—Probably hardly sufficiently distinct from some forms of *A. trifida*, L., but having, however, wingless margins to the petioles.—Southern Arizona (695, 696).

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*MELAMPODIUM, L.—Rays in a single series, fertile; flowers of the disk with an abortive style. Involucre double, the outer series of (4–5) broad foliaceous bracts, which are often connate at base, the inner as many as the ray-flowers and enclosing their achenia. Receptacle strongly convex. Chaff thin, deciduous. Achenia (of the fertile flowers) ovoid, embraced by the hooded inner scales of the involucre.

†BERLANDIERA, DC.—Many-flowered, ligulate rays pistillate. Disk-flowers with an undivided style. Scales of the involucre in three series, the outer small, oblong or oval, the second set larger and obovate, the inner ones largest, rhomboidal, reticulated, bearing on the inner faces the flat, wingless achenia of the ray-flowers. Pappus of the ray of two minute caducous teeth or short awns. Inner face of the ray-achenium is mostly covered by the chaff of two sterile flowers. Pappus of the disk reduced to the merest crown or border.

FRANSERIA* HOOKERIANA, Nutt.—Arizona, New Mexico, and Colorado.

FRANSERIA DUMOSA, Gray.—Low, much branched, shrubby; leaves pinnatifid, with rounded lobes, or bipinnatifid, cinereous, with a short pubescence; mature involucre puberulent or glabrous; spines flat, more or less involute, long and slender.—Arizona.

XANTHIUM STRUMARIUM, L.—Utah.

ZINNIA† GRANDIFLORA, Nutt. (fig. iv, Report of Major Emory, 1848).—Low, much branched from the base, puberulent; leaves linear or linear-lanceolate, connate at base, acute, rather rigid, distinctly 3-nerved; margins ciliate, 5–12″ long; paleæ fimbriate; disk orange and rays yellow. In my specimens, the leaves are not always "impressed punctate", and are sometimes distinctly glandular-dotted.—New Mexico, Arizona, and Colorado. Collected by Dr. Loew and Professor Wolf.

SANVITALIA‡ ABERTI, Gray (Pl. Fendl. p. 87).—Annual, erect, 8′–2° high; stem terete, striate, puberulent, simple or branched; leaves linear or lanceolate, 3-nerved, hispidly scabrous and hispidly ciliate, attenuated into a petiole; heads few-flowered; outer scales of the involucre lanceolate, dry, distinctly nerved and somewhat longer than the ray-achenium; chaff lanceolate, with scarious margins, longer than the disk-flower.—Southern Arizona (519). An exceedingly variable plant.

HELIOPSIS PARVIFOLIA, Gray (Pl. Wright. 2, p. 86).—Erect, smooth or nearly so, simple or branched from the base; leaves petioled, triangular or triangular-hastate, subserrate or sinuate, 12–18″ long; peduncles elon-

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* FRANSERIA, Cav.—"Heads, flowers, &c., as in AMBROSIA, except that the fertile involucre is armed with more than one rank of prickles or spines, and is 1–4-celled and 1–4-flowered."—GRAY, in Fl. Cal. 1, p. 344.

† ZINNIA, Linn.—Heads heterogamous, radiate; both ray- and disk-flowers fertile. Involucre campanulate or sub-cylindrical, the dry, broad, obtuse bracts imbricated in several series, the exterior much shorter; rays orbicular, cordate at the base, with an obcompressed achenium destitute of pappus or with one or two short awns; disk-flowers regular, with a somewhat enlarged tube; anthers entire at base. Achenia angular, with a pappus of short awns produced from the angles; receptacle conical, with many chaffy scales embracing the disk-flowers.

‡ SANVITALIA, Linn.—Heads heterogamous, radiate, ray-flowers fertile, 1–2 series, disk-flowers perfect and fertile. Involucre hemispherical or broadly campanulate, bracts in 2–3 series, somewhat unequal, dry or with herbaceous apices, which on 2–4 of the outer scales are expanded into spreading leaves. Receptacle flat or convex, chaffy, chaff embracing the flowers. Ray-flowers without a tube, as long as the mature achenium, emarginate; achenium triangular, with a short, stout awn produced from each angle. Disk-flowers regular, tubular, but little enlarged upwardly, 5-dentate at the apex; achenia flattened, the outer ones roughened, nearly awnless, and the inner narrowly winged, indistinctly ciliate, and with two inconspicuous awns.—BENTH. & HOOK. in part.

gated, naked, and terminated by a single head 1½–2″ in diameter; involucre with scales in about four series, all distinctly nerved, the outer ovate, obtuse, the inner lanceolate, acute; ligules persistent (fading away into a pale sulphur color), 2–3-toothed at the apex; achenium (ray) 3-angled, rounded, and papillose on the outer side; disk-flowers narrowly tubular; achenia 4-angled; chaff hardly as long as the flower.—Chiricahua Agency, Southern Arizona (536). My specimens are apparently much larger-flowered than those of Mr. Wright, on which the species was founded. They came, however, from near his locality.

Gymnolomia * multiflora, Benth. & Hook. (*Heliomeris multiflora*, Nutt.)—A very variable plant. Nevada, Arizona, Utah, Colorado (779, 551). See vol. v, King's Report, p. 170.

Rudbeckia laciniata, L.—(171 of Loew.) Sangre de Cristo Pass, Colorado.

Rudbeckia columnaris, Pursh, var. pulcherrima. (*Lepachys columnaris*, T. & G., *β. pulcherrima*, Don.)—Erect, simple, or branching from the base, strigose-pubescent; earliest leaves lanceolate and entire; stem-leaves pinnately parted, with linear divisions, petioled; upper ones similar, but sessile; disk columnar, 9–15″ long and 4″ wide; ray-flowers dark purple, reflexed, 6″ long and 4″ wide.—Zuñi Village (159), and also collected by Dr. Oscar Loew in White Mountains of Arizona.

Var. Tagetes. (*Lepachys columnaris*, var. *Tagetes*, Gray, Pl. Wright. 1, p. 106.)—Similar to the above except in having small yellow or brown rays and a shorter disk. Arkansas Valley, Colorado (24, Loew); Valley of the Rio Grande, above Albuquerque (85).

Rudbeckia hirta, L. (apparently).—Trout Creek, Colorado (549, 550).

Rudbeckia occidentalis, Nutt.—Utah.

Balsamorhiza sagittata, Nutt.—Northern Nevada and Utah.

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* Gymnolomia, H. B. et K.—Heads heterogamous, radiate; rays 1-seried, neutral; disk-flowers perfect, fertile. Involucre hemispherical or broadly campanulate; bracts in 2–3 series, exterior herbaceous and a little shorter, interior thinner, all narrow, or rarely with the exterior or interior enlarged. Receptacle convex or conical; chaff concave and embracing the disk-flowers. Ray-flowers ligulate, spreading, entire or dentate. Disk-flowers regular; tube short or with a somewhat dilated base. Anthers entire at base or with two small auricles. Styles of the disk-flowers obtuse or sometimes terminated by a short, acute appendage. Achenia of the ray-flowers narrow, empty; of disk-flowers sub-compressed, 4-angled, obtuse at apex (in our species destitute of pappus).—Erect, branching herbs.—Benth. & Hook.

WYETHIA AMPLEXICAULIS, Nutt.—Utah.

WYETHIA ARIZONICA, Gray.—2–3° high, roughish hirsute; heads 2–4; leaves broadly lanceolate; upper ones sessile; lower ones petioled, a foot or more long; scales of the involucre oblong or lanceolate, cinereous pubescent, ciliate; ligules 12, 10–14″ long; achenia acutely angled, laterally compressed, 1–2- (or the outer ones often 3–4-) awned.—Willow Spring, Arizona (222).—PLATE IX. Branch, natural size. Figure 1. Section through receptacle showing ray-flower and disk-flower in position, the latter subtended by its chaff; somewhat enlarged. 2. Chaff of disk-flower. 3. Disk-flower. 4. Style and stigma of disk-flower. 5. Mature achenium of disk-flower. 6. Style and stigma of ray-flower. 7. Mature achenium of ray. Except where otherwise specified, all enlarged about 10 diameters.

VIGUIERA * LAXA, DC., var. BREVIPES, Gray (Pl. Lindh. 2, 228).—The loosely branching stem herbaceous, strigose-puberulent; leaves with short petioles, ovate or deltoid, plainly reticulated on the under surface, irregularly serrate, scabrous on both surfaces; petioles villose, especially on the upper surface; scales of the involucre in two series, lanceolate, pubescent, and nerved on the back, acute; chaff lanceolate, membranaceous; receptacle convex; achenia flattened and densely covered with an appressed pubescence.—Camp Bowie, Ariz. (501); also collected by Loew in Central Arizona.

VIGUIERA RETICULATA, Watson (Amer. Naturalist, 7, 301).—"White-tomentose; stems herbaceous; leaves subopposite, coriaceous and rigid, broad-ovate, 1–2 inches long, cordate at base, acute, entire, short-petioled, strongly reticulated beneath; bracts small, lanceolate; heads 4–5 together, in short close corymbs; involucral scales imbricated in 3–4 or more series, lanceolate, thick, appressed or the tips spreading; rays entire; receptacle shortly conical; chaff acutish; achenia silky pubescent, the pappus-awns subulate at base; scales lacerate."—Telescope Mountain, Southeastern California. Will probably also appear in Nevada and Arizona. Not having access to a specimen of this species, I have availed myself of the above

* VIGUIERA, H. B. et K.—"Head, flowers, &c. as in *Helianthus*, but usually of smaller size; imbricated involucre less herbaceous; receptacle inclined to be conical; and, especially the pappus less deciduous or even persistent, consisting of 2 or more scarious chaffy scales on each side between the awns."—GRAY, in Fl. Cal. 1, p. 354.

description of Mr. Watson.—Plate IV. Figure 6. A branch, natural size 7. A disk-flower. 8. Chaff of disk-flower. 9. Ray-flower. 10. Section through receptacle. All except the branch enlarged 10–20 diameters.

Helianthus petiolaris, Nutt.—Tall, erect, hispid; leaves scabrous (lower sometimes opposite, upper alternate), ovate or ovate-lanceolate, irregularly serrate-acuminate; petioles long (but variable in length); peduncles terminal; heads large; involucral scales lanceolate or broadly lanceolate, acute; disk-corolla hairy at base; achenia villous; pappus of "two chaffy awns"; rays large, over an inch long.—Southern Arizona, Nevada, and Colorado.

Helianthus annuus, L. (*Helianthus lenticularis*, Dougl., see Gray, Fl. Cal. 1, p. 353; also *H. lenticularis*, Dougl. vol. v, King's Report, and Preliminary Report of Mr. Watson in Wheeler's Survey, Washington, 1874.)—Utah and Colorado.

Helianthus Nuttallii, T. & G.—Nevada and San Luis Valley, Colorado, with broader leaves (548).

Helianthus giganteus, L., var. Utahensis, Eaton—Utah.

Helianthella uniflora, T. & G.—South Park, Colorado (546).

Actinomeris* Wrightii, Gray (Pl. Fendl. p. 85).—Erect, somewhat branching; stems canescently hispid; leaves sessile or slightly decurrent, lower opposite, upper alternate, oblong or lance-ovate, irregularly and strongly serrate, thick, scabrous, and distinctly veined, especially beneath; heads on naked peduncles (6–12′ long), medium-sized; scales of the involucre in 2–4 series, with a short stout pubescence, outer ones shorter, oblong and obtuse, inner lanceolate and acute; rays short, entire or slightly toothed (or sometimes none). Achenia of the disk cuneate-oblong, with a distinct wing extending half-way down the achenium on either side,

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* Actinomeris, Nutt.—Heads heterogamous, radiate; flowers of the ray neutral and in a single series; disk-flowers hermaphrodite, fertile; heads sometimes, by the deficiency of the rays, homogamous. Involucre hemispherical or campanulate; bracts 2–3-seried, unequal, short or the outer ones elongated and foliaceous. Receptacle convex or at length conical, covered with chaff, which embraces the disk-flowers. Ray-corollas ligulate, spreading, entire or 2–3-toothed; disk-flowers regular, with a short tube; limb elongated-cylindrical, 5-cleft at top. Anthers entire at base. Branches of the style in the disk-flowers terminated by acute appendages. Achenia laterally compressed, with margins attenuated and distinctly winged. Pappus usually of two persistent awns.—Scabrous herbs. Leaves opposite or alternate, petioled, sessile, or decurrent. Heads middle-sized, solitary, and with long peduncles or corymbose-paniculate.—Benth. & Hook.

and produced above into a short, stout, inflexed awn (on either side). Chaff twice as long as the achenium; margins scarious and somewhat fimbriate or ciliate.—On limestone rocks, Camp Bowie, Ariz. (452). Comparing the above with the original description, it will be discovered that there are some important differences; but as the specimens have been compared by Mr. Watson with the types in Cambridge, I cannot hesitate to assign them here.—PLATE VIII. Branches, natural size. 1. Ray-flower. 2. Disk-flower and subtending chaff. 3. Disk-corolla, style protruding. (1, 2, and 3 magnified about 2 diameters.) 4. Style and stigma (20 diameters). 5. Mature achenium (15 diameters).

ACTINOMERIS LONGIFOLIA, Gray (Pl. Wright. 2, p. 89).—Stems erect, slender, terete, glabrous; leaves opposite, sub-opposite, or alternate, linear-lanceolate, sessile, acute, denticulate or entire, plainly reticulate, scabrous on upper surface and hispidly scabrous beneath; peduncles corymbose, naked, hispid, monocephalous; heads 1–2′ in diameter; involucre with scales in two series, the outer of which are lanceolate and with attenuated tips, the inner are shorter and obtuse, resembling the chaff of the receptacle, which is hardly longer than the mature achenium; achenia oval, distinctly winged to the bottom, awnless or with a single short awn occasionally; ligules yellow, sometimes 2–3-toothed, 6–10″ long. Leaves sometimes 8′ long and only 6″ wide.—Sanoita Valley, Southern Arizona, (608), and probably not far from the original locality whence it was taken by Mr. Wright.

VERBESINA* ENCELIOIDES, Benth. & Hook. (*Ximenesia encelioides*, Cav., T. & G. Fl. ii, 359.)—Annual, hoary-pubescent, green and almost smooth, branched from or near the base; leaves triangular-ovate or cordate, or sub-hastate, irregularly sinuate-dentate; upper petioles winged and dilated at base into a lobed auricle; involucre with scales in 2–3 series, the outer lanceolate acute, pubescent, the inner shorter and smoother; rays numerous, cuneate-oblong, 4–7″ long, 3-toothed at apex; achenia of the disk with a wide and strong wing; pappus (disk) of two short, weak awns.—San

* VERBESINA, Linn.—Similar to the preceding genus (*Actinomeris*), except that the rays are fertile and the disk-achenia are more distinctly 2-winged and 2-awned.

Luis Valley, Colorado (421), Southern Arizona (772, 462), and Agua Azul, New Mexico (124). A polymorphic plant.

VERBESINA PODOCEPHALA, Gray (Pl. Wright. 2, p. 92).—Erect, 2–3° high, hispid, branching from a woody base; leaves serrate, sub-sessile or even, rarely slightly decurrent, lanceolate to orbicular, 3–5-nerved, with (beneath) veinlets conspicuously netted, beneath glandular hispid, and veins and veinlets with stiff, long, white hairs; peduncle 4–8′ long, monocephalous; scales of involucre in two series, the five outer ovate, roundish, the ten inner longer, chartaceous, and acute; achenia of ray sharply 3-angled or winged, slightly toothed on the angles, the inner flattish, with two (or by abortion one) stiff awns from the angles; flower 1′ in diameter; rays bright sulphur-yellow, oblong, entire or slightly toothed at the apex.—Chiricahua, Ariz. (517).

COREOPSIS TINCTORIA, Nutt.—Ash Creek, Arizona, at 5,000 feet altitude (317).

COREOPSIS CARDAMINEFOLIA, T. & G.—Erect, smooth, slender, almost unbranched; leaves pinnately parted; exterior involucre small; "achenia winged, broadly oval, sometimes with 2 short, subulate teeth"; rays 3-toothed at the summit, twice as long as the interior involucre.—Zuñi Village, Ariz., at 6,700 feet altitude (157).

THELESPERMA* LONGIPES, Gray (Pl. Wright. 1, 109).—"Suffrutescent"; glabrous, much branched; branches short and leafy; leaves 3–5-parted; segments linear-filiform; peduncles 1° long, almost filiform, terminated by a single rayless head; inner series of involucral scales with broad scarious margins; outer series small and obtuse; achenium without pappus (merely a very small crown-like border), slender, terete or nearly so, and tuberculate-rugose on the back; chaff not adhering to the cast-off achenia.—Camp Bowie, Ariz. (451).

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* THELESPERMA, Less.—Heads heterogamous, radiate; flowers of the ray neutral, in a single series; disk-flowers fertile; heads often homogamous from the rays being absent. Involucre double, broadly campanulate; the inner series of subequal membranaceous scales, which are united more than half-way to the summit; the exterior series of a few small bracts. Receptacle flat with many flat scarious palets which subtend the flowers of the disk. Ray-flowers, when present, ligulate, spreading; disk-flowers regular, limb broadly cylindrical or narrowly campanulate, 4–5-cleft. Anthers obtuse at base and entire; styles of the disk-flowers papillose-puberulent at the apex, terminated by an acute appendage. Achenia linear or linear-oblong, somewhat obcompressed truncate at the apex and erostrate, with two retrorsely pectinate-ciliate awns or naked. Rays, when present, yellow; disk sometimes purplish. Achenia smooth or tuberculate.—BENTH. & HOOK.

THELESPERMA GRACILIS, Gray.—Erect, much branched above, smooth; leaves pinnately 5–7-parted, the divisions linear and somewhat rigid; heads hemispherical, on peduncles 4–6′ long; outer series of involucral scales obtuse or acutish; inner series acutish, with margin slightly, if at all, scarious; rays none. ("Achenia oblong-linear, crowned with two stout subulate persistent spreading retrorsely pectinate-hispid awns."—Porter and Coulter in Fl. Col. p. 72.)—Arizona, Loew.

COSMOS* BIPINNATUS, Cav., var. PARVIFLORUS, Gray. (*Cosmos parviflorus*, H. B. K.)—Annual, erect, 6–12′ high, glabrous, leafy; leaves petioled bipinnately parted; segments narrowly linear or capillary; outer series of involucral scales lanceolate, acuminate, as long as or exceeding the inner, obtuse, and somewhat scarious-margined ones; outer achenia short, and the inner ones somewhat longer-beaked; awns variable in number, 2–4.—Arizona (639) and New Mexico.

BIDENS TENUISECTA, Gray.—Annual, glabrous, branching from the base, leafy; leaves bipinnately parted; segments entire (rarely again divided) and lanceolate; scales of the involucre linear, hirsute, especially at base; rays (4–7) hardly exceeding the disk; "achenia attenuate-linear, glabrous subtetragonal"; awns nearly as long as the achenia and very strongly downwardly barbed.—Colorado, in the Arkansas Valley (544).

BIDENS FŒNICULIFOLIA, DC.—Tall, branching, glabrous, or with the youngest branches puberulent; leaves 2–3 times pinnately divided; segments entire or sometimes lobed; involucre with the outer scales linear, ciliate, and nearly as long as the inner ones, which are oval, with yellowish, scarious margins; rays large, 5–6, 8″ long, oval, deep yellow, with plain, brown veins. Achenia (I have not seen) given by Dr. Gray in Pl. Wright. 2, p. 90, as 2½ lines long (the "var. *acheniis minoribus*"), and by DC. Prod. v, p. 603, as 3–3½ lines long, and linear-tetragonal, hardly scabrous at the apex, 2-awned.—Sanoita Valley, Southern Arizona (671).

BIDENS HETEROPHYLLA, Ort.? var.?—Erect, smooth; lower leaves petioled, pinnately "5–7-parted"; segments distant, linear, entire, the terminal

* COSMOS, Cav.—Differs from *Thelesperma* in the inner series of involucral scales not being connate to or above the middle and the rays being rose- or violet-colored, and from *Bidens* in the achenia being more or less rostrate at the apex.

one much longer than the others, 4′ long and 3″ wide; upper leaves sessile, 3-parted; outer series of involucral scales lanceolate, ciliate, as long as the broadly margined inner series. Flowers in my specimen are all too young. Mr. Watson has kindly compared it for me, and pronounces it the same as 1233 of Mr. Wright's collection.

LAPHAMIA STANSBURII, Torr.—Utah.

"LAPHAMIA MEGALOCEPHALA, Watson (Amer. Naturalist, 7, 301).—Scabrous-pubescent; stems diffusely branched, a foot high; branches simple; leaves alternate, broadly ovate, 2–3 lines long, smaller upon the branches, entire, very shortly petioled; heads large, 2–3 lines in diameter, terminal and solitary, discoid, many-flowered; achenia compressed, hispid; pappus none.—With nearly the habit of the last. Nevada." I have quoted the description from Mr. Watson. The specimen I have not seen.—PLATE XI. Figure 1. A branch, natural size. 2. A single flower. 3. Style and stigma. 4. ———. 5. Stamen. Enlarged about 10 diameters.

PERITYLE * EMORYI, Torr. (Bot. Mex. Bound. p. 82).—"Sparsely hirsute as well as glandular: leaves round-cordate or fan-shaped in outline, 5–9-cleft and the lobes copiously incised, the upper alternate and less lobed: scales of the involucre rather broad: rays short, white, broadly oval: style-appendages oblong and obtuse: akenes narrowly oblong, hispid-ciliate: awn of the pappus only one, very slender, sparsely barbellate above" (Gray in Fl. Cal. 1, p. 397). I have not seen the species. Arizona.

RIDDELLIA† COOPERI, Gray (Proc. Amer. Acad. vii, p. 358).—"A foot

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* "PERITYLE, Benth.—Heads many-flowered, with pistillate rays, or occasionally none; the flowers all fertile. Involucre campanulate, of nearly equal scales, slightly carinate on the back, in a single or double series. Receptacle flattish or conical, naked. Rays 3-toothed; disk-corollas 4-toothed; the tube glandular. Style-branches tipped with (or insensibly changing into) a short and obtuse or more commonly subulate or filiform, hairy appendage. Akenes oblong, flat (laterally compressed), dark-colored, bordered by a cartilaginous mostly ciliate-bearded margin. Pappus a series of hyaline or setiform scales, usually more or less united into a cup or crown, and commonly a slender awn from one or both margins.—Rays white (or sometimes yellow?): disk-flowers yellow."—GRAY, Fl. Cal. 1, p. 396.

†RIDDELLIA, Nutt.—"Heads several-flowered, with 3 or 4 pistillate rays and 5 to 12 disk-flowers, all fertile. Involucre narrow, cylindraceous, of 4 to 10 linear-oblong and coriaceous equal woolly scales, which are connivent but distinct, except at the very base, and a few thinner or scarious ones within, sometimes a narrow external bract or two. Receptacle flat, naked and smooth. Rays large for the size of the head, very broad, abruptly contracted at the base into a short tube, truncate and 3-lobed at the end, 5–7-nerved (the nerves converging and uniting in pairs within the lobes), becoming papery, persistent on the akene. Disk-corollas elongated-cylindraceous, with a very short proper tube, 5-toothed at summit; the teeth glandular. Anthers linear, minutely sagittate, or emarginate at base.

or two high, tomentose-canescent; somewhat naked with age: leaves narrowly linear, entire, minutely punctate: heads solitary on filiform pedunceles terminating the branches: akenes glabrous: pappus of oblong erose-laciniate chaffy scales, about a quarter the length of the glandular disk corolla." Not having the specimen, I have been obliged to quote the above from Fl. Cal. 1, p. 373. Arizona.

RIDDELLIA TAGETINA, Nutt.—A foot high, floccose-woolly or smoother with age, much branched; leaves sessile, narrowly spatulate or oblanceolate, 8–18″ long; heads in clusters on the ends of the branches; scales of the pappus entire, about (or more than) half as long as the tube of the disk-flowers; rays somewhat puberulent externally.—Camp Bowie, Ariz. (463), and Alcadonis, N. Mex. (82).

CHÆNACTIS DOUGLASII, Hook. & Arn.—Colorado, about South Park (481, 482); also from Nevada and Utah.

CHÆNACTIS STEVIOIDES, Hook. & Arn.—Independence Valley, Nevada.

HYMENOPAPPUS LUTEUS, Nutt.—Arizona, Colorado, and New Mexico.

HYMENOPAPPUS FLAVESCENS, Gray (Pl. Fendl. p. 97).—Leaves less dissected and divisions larger than in the following variety, in which the flowers are a real yellow.—A somewhat variable species. Colorado.

HYMENOPAPPUS CANESCENS, var. CANO-TOMENTOSUS, Gray (Pl. Wright. 2, p. 94, and Pl. Fendl. p. 97).—Erect, floccose-tomentose; leaves bipinnately parted; segments 3″ long and ½″ wide; inflorescence in a cymose panicle; heads 4″ in diameter; scales of the involucre with petaloid and somewhat scarious tips; chaff of the pappus entire, oval, one-half or one-third as long as the tube of the corolla; achenia turbinate, obscurely 3–5-angled, 15-nerved, villose.—Western New Mexico, Loew.

BAHIA LEUCOPHYLLA, DC.—Nevada.

BAHIA ABSINTHIFOLIA, Benth., var. DEALBATA, Gray.—Erect, branching from a sub-ligneous root, canescent-tomentose; leaves oblong, trifid at base, with middle division often toothed toward the apex or entire, linear-lanceolate obtuse; heads, including the rays, 8″ in diameter; invo-

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Style-branches of the disk-flowers short, truncate-capitate at the apex. Akenes narrow, terete or nearly so, obscurely striate or angled, glabrous, or in one species cobwebby-villous. Pappus of 4 to 6 hyaline nerveless and pointless chaffy scales.—Low and branching woolly herbs, probably all perennial; with alternate, spatulate or linear leaves, either entire, or the radical ones pinnately incised, and corymbose small heads of golden-yellow flowers."—GRAY, Fl. Cal. 1, p. 372.

lucral scales lanceolate, thin, canescent, acutish; pappus scales oblong, scarious, as long as the tube of the disk-flower, with a strong midrib, which does not reach the apex; achenia long-cylindrical or clavate, obscurely angled, pubescent. Entire plant densely covered with a close, white tomentum, which may be readily rubbed off.—Camp Grant, Ariz., at 5,300 feet altitude (457).

HYMENOTHRIX * WRIGHTII, Gray (Pl. Wright. 2, p. 97).—Erect, 2–3° high, glabrous, diffusely branched; lower leaves bi- or tripinnately parted, divisions filiform; upper ones entire or trifid, with the divisions entire; involucre loose, inner series broadly hyaline-margined, purple-tipped; pappus of 12–15 scales, the awn of which is as long or nearly as long as the scale portion. Achenia narrowly turbinate, black, densely silky-villous; rays none.—Camp Grant, Ariz. (763).

HYMENOTHRIX WISLIZENII, Gray (Pl. Fendl. p. 102).—Erect, puberulent, branching; lower leaves bipinnately parted, upper ones trifid or entire; lobes linear or linear lanceolate; rays bright sulphur-yellow, three-lobed; disk-flowers merely lobed, yellow; pappus of 12–15 awns, which are barbellate above and slightly expanded into hyaline wings below; achenia whitish and somewhat silky-villous.—Cottonwood, Arizona, at 4,300 feet altitude (350).

VILLANOVA † CHRYSANTHEMOIDES, Gray (Pl. Wright. 2, p. 96).—Erect,

* HYMENOTHRIX, Gray (Pl. Fendl. p. 102).—Heads heterogamous, or in absence of rays homogamous; rays when present fertile and in a single series; disk-flowers perfect. Involucre turbinate or narrowly campanulate, the appressed membranaceous bracts in two series, the interior of which have the margins and apices scarious or more or less colored; the exterior are shorter and narrower, and slightly, if at all, scarious. Receptacle small and naked. Disk-flowers narrowly campanulate and the limb deeply 5-lobed or 5-cleft. Anthers sagittate at base with small auricles. Styles of the disk-flowers with long branches, which are terminated by broad and acute or short subulate appendages. Achenia narrowly turbinate and more or less silky-villous. Pappus of many hyaline, awn-tipped scales.—Erect, diffusely branching herbs, which are smooth or a little pilose. Leaves alternate, once or twice pinnately parted or the upper ones simple. Heads middle-sized, irregularly paniculate or corymbose. Corollas yellow [or purplish].—BENTH. & HOOK.

† VILLANOVA, Lagasca.—Heads heterogamous, radiate; ray- and disk-flowers both fertile, or sometimes the innermost flowers sterile. Involucre campanulate, the few broad herbaceous bracts sub-equal, subtending the ray-flowers, or even almost embracing their achenia. Small receptacle naked. Ray-flowers ligulate, the blade small, 3-toothed. Disk-flowers regular, tubular; limb 5-cleft, campanulate. Anthers sagittate at base, with small auricles. Styles of disk-flowers having a short acute appendage terminating the branches; achenia cuneate-oblong, truncate, attenuated at base, more or less 3-angled, the exterior strongly and the interior slightly compressed upon the back, smooth, naked.—Diffuse, glandular, pubescent herbs. Inferior leaves opposite, sometimes the superior alternate, ternately or pinnately dissected or often only few-lobed. Heads small or middle-sized, peduncled, irregularly paniculate or corymbose. Corolla yellow. Achenia smooth.—BENTH. & HOOK.

simple or branching toward the summit; leaves 1–2-ternately parted, the divisions spatulate or oblanceolate, obtuse, simple or lobed; scales of the involucre equal, acuminate, in 2–3 series; ray-flowers about 15 (disk-flowers many); blade toothed or lobed; tube of the disk-flowers externally glandular-hairy; achenia narrowly turbinate or clavate, black, slightly quadrangular, smooth, ribbed or striate, and longer than the corolla; pappus none—Arizona (812, 609).

PALAFOXIA LINEARIS, Lag. (*vide* Botany of Fortieth Parallel, p. 424).—Arizona.

PALAFOXIA HOOKERIANA, T. & G. ?, probably var. *subradiata*, T. & G.—6–12′ high, simple or branched; leaves linear or linear-lanceolate, hirsute, 1–1½′ long; pedicels and flowers viscidly glandular-hairy; scales of involucre lanceolate, acute, sub 2-seried; rays variable, large or small, regularly or irregularly 3-cleft; pappus (ray) reduced to small obtuse scales, half a line long; achenia sub 4-angled, hairy, broadly clavate; disk-flowers deeply 5-parted; tube long and slender, or short and thick; pappus of 5–8 lanceolate or oblong scales, which are nearly as long as the hairy, clavate achenia.—A plant which appears to be variable in almost everything about the flower except the disk-achenia. Deserts of New Mexico, Loew.

POROPHYLLUM* MACROCEPHALUM, DC.—Annual, erect, glabrous; lower leaves linear, upper broadly oval (all petioled and glaucous) and sinuate-dentate; marginal glands nearly a line long and half as wide; flowers solitary, terminating the pedicels, which are hollow and dilated above; scales of the involucre linear, 10″ long, with one or two lines of glands 1½″ long and ¼″ wide; achenia clavate, hairy; pappus fulvous, rough, with delicate hairs, nearly or quite as long as the slender flower-tube; limb of the flower dark brown.—A striking species, found usually on or near limestone rocks. Sanoita Valley, Arizona, at 4,500 feet altitude (682).

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*POROPHYLLUM, Vaillant.—Head several- to many-flowered, with all the flowers perfect. Involucre cylindrical or cylindraceous, of 5 to 10 oblong or linear equal scales in a single series. Receptacle small, naked. Corollas with a slender or filiform tube and a narrow 5-cleft limb. Style-branches slender, tipped with a subulate-filiform hispid appendage. Akenes long and slender, nearly terete, striate or angled. Pappus of copious, rather rigid, scabrous, capillary bristles, about the length of the corolla.—Herbs glabrous and often glaucous; with slender branches terminated by pedunculate heads of yellow, whitish, or purplish flowers, and alternate, or below, opposite leaves; these and the scales of the involucre marked by scattered immersed oil-glands, in the manner of *Tagetes*; &c., therefore strong-scented.—GRAY, Fl. Cal. 1, p. 398.

TAGETES* MICRANTHA, Cav.—Annual, smooth, 2–6′ high; stem simple or nearly so; leaves opposite, entire and filiform or pinnately parted, and the divisions filiform; flowers terminal; scales of the involucre in a single series somewhat united at base, abruptly truncate and sometimes bristle-tipped; rays white, 1–3 in a head, 1–2″ long, entire or slightly denticulate; disk-flowers about 5; pappus of two rough awns nearly as long as the *distinctly striate* linear achenia, and of 2–3 scales half as long as the awns, which they sometimes enclose.—Sanoita Valley, Southern Arizona, on rocky hillsides (616).

PECTIS† FILIPES, Gray.—Annual, much branched; leaves smooth, narrowly linear, 12–18″ long, less than 1″ wide, with numerous glands, 2–3 bristles on either side at base; peduncles capillary, more than an inch long; involucre of five lanceolate scales, with more or less scarious margins, frequently gland-bearing; rays exserted half their length, not more in number than the disk-flowers (5); disk-flowers half as long as the rays; achenia linear, hairy; pappus usually of two stiffish awns, which are somewhat thickened at base and slightly scabrous above, or occasionally reduced to one awn and a crown of minute scales. An exceedingly variable species, which Bentham and Hooker, in Gen. Plant., have assigned to the older *P. Taliscana*, Hook. & Arn. I can see no warrant for this, if the description in Bot. Beechey be correct. It should, however, be stated that the plant appears there to have been described from imperfect material, and more

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* TAGETES, Linn.—Heads heterogamous, radiate; ray- and disk-flowers both fertile, or heads sometimes homogamous, the rays being absent. Involucre cylindrical, the bracts 1-seried and more or less united, rarely a single small exterior bract is present. Receptacle flat, often small, naked or somewhat alveolate-fimbrillate. Ray-corolla ligulate; disk-flowers perfect and fertile, regular, tubular, the limb often enlarged, 5-cleft. Anthers at base obtuse, entire. Style-branches of the disk-flowers slender, truncate, penicillate or short appendiculate. Achenia linear, attenuate at base, compressed or angled, hardly striate, with a [somewhat] conspicuous callosity at base. Pappus variable [in our species, *micrantha*, of 2 awns and 2–3 shorter scales].—Erect, branching or diffuse glabrous herbs, with the leaves and involucre having distinct, strongly scented glands.—BENTH. & HOOK.

† PECTIS, Linn.—Heads heterogamous, radiate; ray-flowers in a single series and fertile, as the disk-flowers also. Involucre cylindrical or campanulate, the free, equal bracts in a single series. Receptacle small, naked. Rays with a small or narrow blade, spreading, entire or 3-toothed; disk-flowers perfect, the ampliate tube short, equally or unequally 5-cleft. Anthers obtuse, sub-entire at the base. Styles of the disk flowers elongated, slender, somewhat hairy, with very short, obtuse branches. Achenia linear, somewhat angled, delicately striate. Pappus of few or many bristles, oftener smaller, fewer or simply reduced to scales in the ray than in the disk, or sometimes consisting entirely of small scales resembling a crown, or with these and the bristles intermixed.—Herbs, the leaves and involucral scales of which often abound in strong-scented glands. Flowers yellow [in *P. imberbis* purple].—BENTH. & HOOK.

perfect specimens may have enabled those authors to place *P. filipes* under *P. Taliscana* with certainty. Dr. Gray, Fl. Cal. 1, p. 400, still considers them distinct.—Southern Arizona (539) In one specimen, I find three awns to the disk-flowers, which alternate with three scales, each half as long as the achenium.

PECTIS ANGUSTIFOLIA, Torr.—Low, much branched, annual, 1–6′ high; leaves slightly connate and bristle-ciliate at base, bearing many oval glands, as also do the scales of the involucre; pappus in both ray- and disk-flowers a mere crown of small and somewhat dentate scales, or in some of the outer flowers of the head of one or two awns, when it is *P. fastigiata*, Gray (Pl. Fendl. p. 62); achenia a little hairy.—A very much dwarfed form of the species, not over half an inch high, is in the collection, obtained by Dr. Loew, probably from New Mexico. Colorado (467).

PECTIS PAPPOSA, Gray.—"Annual, glabrous, diffusely much branched, a span to a foot high, 'lemon-scented': leaves elongated-linear (2–3′ long, less than a line wide), furnished with very few bristles at base: heads slender-peduncled, scattered or corymbose, about 20-flowered: scales of the involucre 6–8-linear; rays, elongated, linear-oblong: pappus in the ray a scaly crown, in the disk of 15–20 capillary and very unequal barbellate bristles. Pl. Fendl. p. 62." Not having access to satisfactory specimens of the above species, I have been obliged to appropriate the above complete description from Fl. Cal. 1, p. 399.—Obtained by the Expedition in Arizona.

PECTIS TENELLA, DC.—Low and diffusely branched, smoothish; leaves 1–2′ long, nearly a line wide; margins slightly revolute and bearing a few oval glands; rays twice (or nearly so) as long as the scales of the involucre, pappus (ray) *a few small scales* or rarely with an awn; disk-flowers about 10, two-thirds as long as the ray; pappus (disk) of about 15 very unequal and strongly upwardly barbed bristles; achenia sub-angled and hairy. My specimens do not at all accord with the description in DC. Prod. vol. v, p. 99, and I am unable to separate them clearly from the above description of *P. papposa*. Mr. Watson, however, has kindly compared them at Cambridge for me, and I accept his conclusion.—Camp Bowie, Ariz. (446); also obtained by Dr. Loew from Mount Turnbull, in the same region.

PECTIS LONGIPES, Gray (Pl. Wright. 2, p. 69).—Annual, diffusely

branched; branches procumbent or ascending, conspicuously angled and striate, smooth; leaves 1–2′ long, half a line wide, the margins copiously provided with roundish, brown glands, with several long bristle-like hairs at base; peduncles 3–6′ long, with several small scale-like bractlets, filiform; involucral scales linear-lanceolate, glandless or with but a single gland; ray-flowers 7″ long, pappus (ray) of two strong awns; disk-flowers 4″ long, pappus (disk) of many unequal and scabrous bristles; achenia reddish, angled and roughish.—A well-marked species from the Sanoita Valley, Arizona (635).

PECTIS IMBERBIS, Gray (Pl. Wright. 2, p. 70).—Erect, much branched herb, 1–2° high, smooth; leaves scattered, few, gland-dotted, filiform, 2–3′ long; inflorescence paniculate-cymose; pedicels bracteolate; involucre scales lanceolate, obtuse, enfolding the ray-achenia; ray-flowers purple (as are also those of the disk and also the involucre scales); blade oval and twice as long as the tube; disk-flowers with the tube short and limb dilated upwardly, very slightly bilabiate, a dark gland on each lobe. Achenia (disk and ray) narrow, hairy; pappus of two small scales, with smaller ones between, and some more or less lacerate. The plant emits a terebinthinate odor, and is almost as naked as though it had no leaves.—Sanoita Valley, Arizona (636).

PECTIS PROSTRATA, Cav.—Prostrate, branching herb, puberulent; leaves broadly linear or lanceolate (1′ long and 1½″ wide), entire, and strongly bristle-ciliate at base; heads sessile and somewhat congested; involucre of five oval scales, which are truncate at top and hyaline on the margins, not embracing the ray-achenia; limb of the ray-corolla less than twice as long as the tube, and both combined shorter than the achenium; pappus (ray) of 2–4 lanceolate, acute, somewhat lacerate scales, which are half as long as the hairy achenium; disk-flowers almost cylindrical, and not longer than the five lanceolate, hyaline, and very acute scales of the pappus. Achenia narrow and hairy (almost hairy-tufted at the apex). The dark glands are scattered throughout the entire blade of the leaf.—Dry open plains of Southern Arizona (722).

HELENIUM AUTUMNALE, L.—Utah.

HELENIUM HOOPESII, Gray.—Sierra Blanca, Arizona, at 11,500 feet

altitude (808). This plant was found blooming higher and later than any other species in Arizona. From the summit of Mount Graham, at 9,000 feet, we have the variety "canescens, pube lanulosa decidua indutum" (Gray), some heads of which have the rays almost entirely wanting. (404.) For a recent arrangement of the genus by Professor Gray, see Proc. Amer. Acad. ix, p. 202 *et seq.*

GAILLARDIA ARISTATA, Pursh.—Perennial, 6′–2° high, pubescent (unbranched?); lower leaves linear-lanceolate, *obspatulate or pinnatifid*, on long-margined petioles, upper ones sessile and usually entire; heads 2–4′ in diameter; rays 1′ or more long, usually entire, yellow; pappus of the ray-flowers somewhat shorter than that of the disk; tube of the disk-flowers short, limb cylindrical, glandular-hairy above, and with the lobes bristle-tipped; scaly pappus lanceolate, one-quarter as long as the limb, midrib produced into an awn nearly as long as the disk-flower; achenia slightly hairy; bristles of the receptacle stout, 3–4 times as long as the achenia, thickened at the base.—Colorado, in South Park (483).

GAILLARDIA PULCHELLA, Fougeroux.—Erect, branching, smooth; lower leaves petioled, lanceolate-spatulate, upper ones sessile, broadly lanceolate or oblong; peduncles 4–6′ long; scales of the involucre in two series (the inner shorter), tips much attenuated; rays orange-colored, cuneate, deeply three-lobed; disk-flower lobes purple, glandular-hairy, drawn out into a bristle tip; pappus (disk) with the scales broadly oblong and the midrib as long as the flowers; awns of the receptacle thickened and hardened at base, four times as long as the achenium, which is densely covered with ferruginous hair (or, as expressed by Torrey and Gray, "involucrate with a villous ferruginous tuft"). This and the above species often closely resemble one another in the flowers. Indeed, in a specimen from the Laramie Mountains, named by Dr. Gray *G. aristata*, I find the hairy achenium much more like that of *G. pulchella* (which, from the unbranched stem and pinnatifid leaves), it can hardly be.—Cottonwood, Arizona (345).

ACTINELLA ACAULIS, Nutt.—South Park, Colorado, at 12,000 feet elevation (457).

ACTINELLA ARGENTEA, Gray (Pl. Fendl. p. 100).—Stem at base, short, thick, woody, and branched almost as in *A. acaulis* and leafy; above slender,

with a few leaves, and terminating in a leafless peduncle 2–4 inches long; lower leaves 3-nerved, spatulate, tapering into a petiole, upper leaves sessile and spatulate, all (as also the stem and involucre) densely silky-pubescent; involucral scales thickish and lanceolate, in 2–3 series, and not longer than the disk-flowers; rays about 15, cuneate, 3-lobed, nearly 6″ long; hyaline scales of the pappus broadly ovate, short-awned, glistening; achenia hairy, cuneate.—This beautiful little species was obtained from Santa Fé, N. Mex. (5), where it was first detected by Mr. Fendler in 1847.

Actinella Richardsonii, Nutt.—South Park, Colorado (484); also from Western New Mexico, Loew.

Actinella grandiflora, T. & G.—Several erect branches, 6–12′ high, from the short stem; entire plant more or less densely covered with a long, loose wool; lower leaves pinnately or sometimes bipinnately parted, the divisions linear; petioles margined with dilated and sheathing bases; involucre densely woolly; scales linear, acute, about as long as the hemispherical disk; head (including the rays) $1\frac{1}{2}$–$2\frac{1}{2}$′ in diameter; rays oblong or cuneate, 6–12″ long. Apex somewhat truncate, 3-toothed or lobed; disk-flower lobes rather short and obtuse, glandular-hairy; achenia roughish-hairy, with from 6–8 thin, lanceolate, acute pappus-scales.—In Colorado, the most striking plant blooming at an altitude of 12,000 feet (578).

Actinella scaposa, Nutt., var. linearis, Nutt.—Perennial, villous or cinereous-pubescent; scapes numerous, from a much-branched caudex; leaves many, narrowly linear, 2–4′ long and hardly a line wide, glandular-dotted petioles expanded into sheathing bases; scapes 4–12′ long, terminating in a single head, which, with the rays, is 18″ across; scales of the involucre in two series, oblong, obtuse and quite villous; rays oval or cuneate, oblong, 3-toothed, the tube hairy; achenia pyriform, hairy, of five oblong or oval scales, with or without short awns; disk-flowers with almost no tube, and an upwardly dilated, gland-dotted limb, the lobes obtuse, short, and glandular-hairy; achenia as in the ray, except that the pappus is conspicu ously tipped with a bristle-like awn.—Covero, N. Mex. (104).

Achillea Millefolium, L.—Nevada, Utah, Colorado, and Arizona, in the pine region of the White Mountains.

LEUCAMPYX* NEWBERRYI, Gray (Porter and Coulter in Fl. Colorado, p. 77).—Herbaceous, erect, 1–2° high, at first closely covered with a loose, fine wool, but becoming almost glabrous later; radical and lower stem-leaves petioled (the bases of the petioles are dilated and somewhat sheathing), bipinnately parted, the divisions linear, obtuse, and entire; upper leaves linear, entire, or remotely toothed; head (including rays) 2–2½′ in diameter; scales of the involucre very woolly and somewhat exceeding the disk; ray-flowers yellow, fading into a "cream-color"; limb oblong or oval, and sometimes toothed at the apex; disk-flowers yellow; achenia black.—Western New Mexico, at 6,500 feet altitude, Loew. This rare plant was also obtained in 1872 by Professor Porter at the "Soda Springs, 35 miles northwest of Cañon City", and a good description of it furnished in the Flora of Colorado.—PLATE XII. Natural size. Fig. 1. Vertical section through the receptacle, showing ray- and disk-flowers; also involucral scale and embracing chaff. 2. Single involucral scale. 3. Ray-flower. 4. Chaff of the receptacle. 5. Disk-flower. 6. Style and stigma. All except the branch enlarged about 7 diameters.

BAILEYA MULTIRADIATA, Gray (Pl. Fendl. p. 105).—More or less densely floccose-woolly, *usually* but little branched at the base; leaves once or twice pinnatifid; peduncles 4–12′ long, and terminated by a large head 1½–2′ (including rays) across; rays yellow, very many, in two ranks, cuneate-oblong, somewhat sharply 3-toothed, ½′ long.—Camp Bowie, Ariz. (495), and El Rito, N. Mex. (97). The Expedition has it also from Nevada.

Dr. Gray (Pl. Fendl. p. 106) remarks of *B. pleniradiata*, "that the style branches exhibit a more or less distinct central mucronation, or slight cone; in the others [species] they are absolutely truncate." I find in the specimens of *pleniradiata* from Southern Utah, collected by Dr. Parry, that this

* LEUCAMPYX, Gray.—Heads heterogamous, radiate; rays in one series, and, as also the disk-flowers, fertile. Disk-flowers perfect. Involucre broadly hemispherical; bracts 2–3 series, imbricated, broadly scarious at the apex. Receptacle somewhat convex, chaff membranaceous-hyaline, partly including the achenia. Tube of the ray-flowers slender; limb bread 3-toothed or 3-cleft. Disk-flowers tubular, regular; limb campanulate; apex 5-cleft. Anthers obtuse at base, entire. Style-branches of the disk-flowers at the apex short appendiculate, penicillate. Achenia cuneate, incurved, compressed on the back, sub 3-angled, attenuate at base, obtuse at apex; pappus none.—BENTH. & HOOK.

cone is clearly defined, but in some of my Southern forms of what I can only consider as *multiradiata* that it is also slightly present—*i. e.*, the style branches are not absolutely truncate. Whilst in the main I can recognize marked differences between these two species, the wide range of variation in the rays, size, branching, etc., makes me regard the differences as in the highest sense simply one of degree. It is noteworthy, too, that these two forms appear to come nearer to each other as we go southward.

ARTEMISIA DRACUNCULOIDES, Pursh.—Twin Lakes, Colorado (530); also obtained from Arizona and Utah.

ARTEMISIA BOREALIS, Pallas.—South Park, Colorado (535, 536). Alpine.

ARTEMISIA CANADENSIS, Michx.—Arizona; also from Colorado (532).

ARTEMISIA TRIDENTATA, Nutt.—Twin Lakes, Colorado (431); also from the New Mexican deserts, Loew.

ARTEMISIA DISCOLOR, Dougl.—Southern Arizona (753).

ARTEMISIA LUDOVICIANA, Nutt.—Colorado (529) Arizona, by the earlier explorations of the Survey, and later by Loew from Mount Turnbull. The latter specimen looking toward var. *Mexicana*, Gray, having the upper leaves trifid and the margins revolute, and the entire plant (especially younger specimens) tomentose-canescent. From the San Luis Valley, Colorado, we have, in 1873 (539), a much narrower-leaved form (*tenuifolia*, Gray), which Dr. Gray intimates may be a distinct species.

Var. DOUGLASIANA, D. C. Eaton, is from Southern Arizona (717) and from Utah. Varieties *latiloba*, Nutt., and *latifolia*, T. & G., also from Utah.

ARTEMISIA FRIGIDA, Willd.—From plains between Denver, Colo., and the foot-hills (469). To this we frequently find *Aphyllon fasciculatum*, T. & G., attached; parasitic attachments uniting the rootlets of the two.

ARTEMISIA SCOPULORUM, Gray.—South Park, Colorado (430). Alpine.

ARNICA CORDIFOLIA, Hook.—Clear Creek, Colorado (570).

ARNICA ALPINA, Læstad. (*Arnica angustifolia*, Vahl.)—Clear Creek, Colorado (569).

ARNICA LATIFOLIA, Bongard.—Utah.

ARNICA LONGIFOLIA, D. C. Eaton.—Utah.

ARNICA FOLIOSA, Nutt.—More than a foot high, erect, simple, tomentose or glandular-pubescent; lower leaves petioled; upper ones sessile,

slightly connate at base, lanceolate, callous-denticulate, sometimes with 3–5 distinct ribs; flower, including rays, 18″ in diameter.—Twin Lakes, Colorado (568).

Senecio lugens, Richardson, var. Hookeri, D. C. Eaton. (*Senecio lugens*, Hook.)—Nevada.

Var. foliosus, Gray. (*S. lugens*, var. *exaltatus*, Eaton in Bot. King's Exped. [*fide* Gray].)—"Hoary with white wool up to the flowering state, and the stem conspicuously leafy almost to the top" (Gray, Fl. Cal 1, p. 413.)—South Park and Twin Lakes, Colorado (567, 587).

Senecio triangularis, Hook.—Twin Lakes, Colorado (563); Utah.

Senecio Andinus, Nutt.—Mountains of Colorado near South Park (564, 565).

Senecio aureus, L., var. croceus, Gray.—Utah. Var. borealis, T. & G.—South Park, Colorado (566). Var. Wernerifolius, Gray (Proc. Phila. Acad. Nat. Sci. March, 1863, p. 68).—Cæspitose, woolly at first; radical leaves entire, petioled, spatulate-lanceolate, thickish, margins slightly revolute, canescently tomentose beneath, more nearly glabrous above; scape leafless or with one or two bracts.—South Park, Colorado (588), where it appears to be a common form and to hold its characters well.

Senecio Douglasii, DC.—Glabrate form, from San Francisco Mountains, Arizona.

Senecio canus, Hook., var., with narrower, more entire leaves, and longer rays than usual.—South Park, Colorado (559).

Senecio cernuus, Gray (Silliman's Journ. n. s. vol. 33, p. 10).—"Glabrous stem slender, $1\frac{1}{2}^{\circ}$ high, terminated by a many-headed panicle; leaves lanceolate attenuate at base into a long, margined, subciliate petiole, sparingly sharply toothed or subentire; heads smallish (hardly 6″), discoid, nodding on a 1–2-bracteolate pedicel; involucre sub-calyculate, of lax bracteoles; ovary smooth."—Twin Lakes, Colorado (583). For want of the specimen, I have been obliged to quote the original description of Professor Gray.

Senecio longilobus, Benth., var floccoso-incana, Gray.—2° high, from a woody base, much branched; entire plant more or less white and floccose-canescent; leaves 1–3′ long, entire and narrowly linear or deeply

3-parted or pinnate, with the divisions all linear; inflorescence cymose-paniculate; pedicels few, bracteolate below; involucre scales with two thick nerves; loosely calyculate beneath the head. A most variable species, already noted by Dr. Gray as being with *S. spartioides* and others inextricably confused.—New Mexico, where it is one of the commonest plants of the dry hill-sides.

Senecio spartioides, T. & G.—Smooth, suffruticose, much branching; leaves 2–3′ long and a line wide, entire or *very* sparingly toothed; heads corymbose, or corymbose-paniculate; peduncles short, minutely bracteolate, calyculate scales subulate or narrowly lanceolate; involucre cylindrical, scales thin, nerves delicate; achenia silky-caneseent.—Valley of the Upper Arkansas, Colorado (589).

Senecio eremophilus, Richards.—San Luis Valley, Colorado, a narrow-leaved form (561, 562); also New Mexico.

Senecio Fremontii, T. & G.—Colorado; among the mountains at 11,500 feet and upward (571, 572, 576); contracted above, smooth, striate. Mountains of Colorado, at 12,000 to 13,000 feet altitude (573, 575).

Senecio Bigelovii, Gray.—Erect, smooth, branching toward the top; lower leaves 5–8′ long, less than an inch wide, irregularly sinuate or dentate, the tips of the teeth callous, somewhat falcate, tapering toward the base into a margined petiole; upper leaves sessile and more reduced; heads large, homogamous, nodding, calyculate scales subulate, involucral scales in two series, lanceolate, the inner ones more decidedly scarious-margined than the outer. Achenia oblong, distinctly ribbed, and in some cases under the lens faintly glandular; root a cluster of fleshy fibres.—Mount Graham, at and above 9,000 feet (762); also from the Sierra Blanca, Arizona; also var. monocephalus (Gray?), Twin Lakes, Colorado (587, 674).

Senecio Fendleri, Gray (Pl. Fendl. p. 108).—Twin Lakes, Colorado (557).

Senecio Soldanella, Gray (Proc. Acad. Nat. Sci. Phila. March, 1863, p. 76).—Dwarf, sub-caulescent; root fibrous and fasciculate, glabrous and usually glaucous, monocephalous; lower leaves orbicular, 1½–2′ in diameter, purplish beneath, on petioles 6′ long, which are widely scarious-margined; upper leaves smaller and on shorter petioles, the highest one

reduced to a small lanceolate bract; head 1′ in diameter, calyculate scales linear, acute; inner scales (involucre proper) broader, acuminate, and somewhat wavy at apex; achenia somewhat cylindrical.

Tetradymia canescens, DC., var. inermis, Gray.—Eastern Arizona, at 6,500 feet altitude, Loew; also from Southern Colorado (449, 855).

Cnicus Drummondii, T. & G., (462); and also var. acaulescens, Gray (461). Colorado.

Cnicus undulatus, Gray (Proc. Amer. Acad. x, 42).—South of Camp Apache, at 5,900 feet (293); and Mount Graham, Arizona, at 9,000 feet (742).

Var. megacephalus, Gray (*l. c.* p. 42).—Head 2–2½′ in diameter; involucral scales broader than in the type of the species and spines (of scales) rather shorter.—Camp Apache, Ariz. (256); also elsewhere from Arizona and Utah.

Cnicus Arizonicus, Gray (*l. c.* p. 44). (*Cirsium undulatum* var., Gray, Pl. Wright. 2, p. 101.)—My specimen, *a very smooth* form, may be briefly described thus:—glabrous, 3–4° high, and loosely branched; leaves pinnatifid, with the divisions tipped with long spines; peduncles short; scales of involucre longer and comparatively narrower from without inward, the outermost distinctly spine-tipped (the innermost acute, but hardly spine-tipped); "*stigmatic tip to the style barely* 4–6 *times longer than thick and the node at its base manifest.*"—Central Arizona (289); Colorado (463).

Cnicus Neo-Mexicanus, Gray (*l. c.* p. 45). (*Cirsium Neo-Mexicanum*, Gray, Pl. Wright. 2, p. 101.)—1–2° high, covered with a dense, soft, white wool (becoming less so with age); lower leaves petioled, deeply pinnately parted, the lobes tipped with well-marked spines, with margins between spiny-ciliate; upper leaves sessile, less deeply pinnatifid and smaller, becoming gradually reduced to bracts; heads hemispherical, 1–2′ in diameter; outer scales of the involucre reflexed, and with tips more strongly spinescent than the inner ones; corolla somewhat irregularly cleft; lobes twice as long as the throat; anthers with a minute spiny tip, longer than each anther is wide.—Santa Fé, N. Mex. (62).

Cnicus Parryi, Gray (*l. c.* p. 47).—Greenish, or even somewhat glaucous, slightly tomentose; leaves lanceolate, irregularly, deeply dentate,

the teeth tipped with longer spines than are found on the inter-dental margins; heads many, 1–1½′ in diameter, the subtending bracts spiny-margined and tipped; outer involucral scales strongly ciliate-fringed; inner ones less so, except at the tip, which has a small, oblong, ciliate, spine-tipped appendage 1–2″ long and half as wide; flowers light yellow.—Twin Lakes, Colorado (460).

Centaurea* Americana, Nutt.—Erect, 4°, smooth; leaves sessile, entire, glabrous or nearly so, but with margins slightly ciliate; heads, including the long purple rays, 4′ in diameter; outer scales of the involucre very short and tipped with a lanceolate, brown, pectinate-ciliate appendage as long, or longer than the scales, the inner series becoming regularly longer and more scarious, the appendage remaining same size as in the outer series; pappus of rigid, similar, roughish bristles.—Chiricahua, Southern Arizona (527).

Perezia† Wrightii, Gray (Pl. Wright. 1, p. 127).—"Smoothish; the leafy herbaceous stem 2° high, from a perennial root; leaves thin, membranaceous, oblong-ovate, spinulose-denticulate, the larger doubly dentate, sessile and at base often auriculate; compound corymb polycephalous; heads 8–10-flowered, sub-fasciculate, involucre viscid sub-puberulent, scales hardly in 3 series, oblong and rather obtuse; achenia glandular, the soft white pappus of delicate bristles. Well distinguished by its membranaceous leaves and small heads" Not having the plant, I have quoted the original description.—Arizona.

Perezia nana, Gray (Pl. Fendl. p. 111).—2–12′ high, the single-headed leafy branches erect from a woolly, creeping root; leaves thickish, strongly reticulate, ovate or a little cuneate at base, sessile, very irregularly toothed, teeth spiny or mucronate-tipped from the produced nerves; heads

* Centaurea, L.—Head many-flowered; ray-flowers mostly large and sterile, sometimes wanting; involucre various, imbricated. Receptacle setose. Achenia compressed. Pappus occasionally wanting or nearly so, but usually composed of scabrous filiform bristles, in one or more series, the inner often smaller and somewhat connivent.—T. & G.

† Perezia, Lagasca.—"Head several–many-flowered; the flowers all perfect. Involucre turbinate or campanulate; its scales imbricated, lanceolate or oblong, mostly chartaceous. Receptacle flat and naked. Corolla with a slender tube and bilabiate limb; the outer lip much longer and 3-toothed; the inner 2-toothed or 2-cleft. Anthers with long naked tails at base, and a lanceolate terminal appendage. Akenes elongated-oblong, terete or slightly angled, often obscurely narrowed at apex, commonly glandular. Pappus of copious scabrous capillary bristles.—Herbs; with alternate and mostly rigid leaves, and solitary or usually paniculate heads of purple or white flowers."—Gray, Fl. Cal. 1, p. 422.

about 25-flowered, sessile or on very short pedicels, and not higher than the topmost leaf, campanulate; scales of the involucre acute, faintly ciliolate, slightly mucronate, the inner ones much longer, the outer ovate; achenia glandular-puberulent.—Arizona.

Crepis glauca, T. & G. Fruit needed to decide, but probably this.—Willow Spring, Arizona (218).

Crepis runcinata, T. & G.—San Luis Valley, Colorado (664).

Crepis occidentalis, Nutt., var. gracilis, Eaton.—Nevada and Utah.

Crepis acuminata, Nutt.—Nevada.

Malacothrix Fendleri, Gray (Pl. Wright. 2, p. 104).—"Dwarf, glabrous; stems many, diffuse, from a delicate root; younger leaves sparingly arachnoid, radical runcinate-pinnatifid dentate or the lobes cuspidate mucronate, the cauline few, linear, the highest entire; achenia almost cylindrical. Many-ribbed [15-ribbed]; the apex manifestly cupulate, the cupule entire; pappus of *a single persistent* bristle, with a few *smaller caducous* ones." I have not the specimen in my collection.—Bowlder, Colo. (466).

Malacothrix sonchoides, T. & G.—Similar to the above, except that "the entire pappus is deciduous in a ring", the summit of the achenia is not contracted, and of the 15 ribs some are stronger than the others, and the crown-like border of the akene is 15-denticulate.—Nevada and Utah.

Troximon aurantiacum, Hook., var. Parryi, Gray. (*Macrorhyncus troximoides*, T. & G.)—Colorado (66, 668), Nevada, and Utah. Including here as a mere form (so considered by Dr. Gray), Troximon parviflorum, Nutt., from South Park, Colorado (665, 666).

Pyrrhopappus Rothrockii, Gray (Proc. Amer. Acad. xi, p. 80).—Slender; over a foot high, from a fusiform root, simple or leafy and branching below; one–few-headed; linear leaves entire or toward the base somewhat fringed-pinnatifid or dentate; peduncle slender, almost naked; head narrow, about 20-flowered; the few exterior scales of the involucre subulate, appressed; achenia rugulose, above scabrous; mature pappus dirty white.—Fisch's Ranch, Southern Arizona, at 5,000 feet altitude (699).—Plate XIV. Natural size. 1. Flower, enlarged about 5 diameters. 2. Style and stigma, about 15 diameters. 3. Young head closed, about 4 diameters. 4 Ache-

nium and pappus, about 5 diameters. 5. Involucre reflexed, showing markings on convex receptacle, magnified about 4 diameters.

LACTUCA PULCHELLA, DC. (*Mulgedium pulchellum*, Nutt.)—Cottonwood Creek, Colorado (670).

SONCHUS ASPER, Vill.—Utah.

CHÆTADELPHA* WHEELERI, Gray (Watson, Amer. Naturalist, 7, 301).—Stems numerous, flexuose, 1° high; leaves linear-lanceolate, 1–2′ long, entire, acute, rather rigid; flowers apparently rose-color; involucre 6″ long; achenia 3–4″ long, the brownish pappus exceeding the involucre. With the habit of *Lygodesmia juncea*, in which genus Bentham and Hooker are disposed to place it.—Southern Nevada.—PLATE XV. Natural size. 1. Involucre, enlarged about 4 diameters. 2. A single flower, about 5 diameters. 3. Style and tube of anthers laid open, about 10 diameters. 4. Mature achenium and pappus, 4 diameters. 5. A branching bristle of the pappus, 10 diameters.

STEPHANOMERIA MINOR, Nutt.—Trout Creek, Colorado (671, 672); also Central Arizona (361, 205).

CAMPANULACEÆ (including LOBELIACEÆ).

LOBELIA CARDINALIS, L., var. TEXENSIS.† (*L. Texensis*, Raf.)—Flowers as a rule smaller than in our Northern form, and upper anthers more hairy *toward* the apex; "leaves narrowly lanceolate." Closely resembling *L. splendens*, Willd., as seen in No. 209, Palmer, 1875, but is a coarser, more rigid plant, which may be merely accidental.—Camp Bowie, Ariz. (448).

LOBELIA GRUINA, Cav. (ic. 6, p. 8, t. 511, f. 2)—Perennial, erect, slender, branching toward the top, glabrous or slightly puberulent below; lower leaves lanceolate, obtuse, somewhat puberulent, irregularly crenate-denticulate, 2–3′ long; upper leaves linear, acute, sometimes denticulate; slender flowering branches with the leaves fewer and smaller, narrowly linear

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* CHÆTADELPHIA, Gray.—"Heads about 5-flowered, ligulate. Involucre cylindrical, of lanceolate-linear, membranaceous, keeled scales, enclosing the achenia, the exterior scales calyculate. Receptacle naked. Ligule short, apparently rose-color. Achenia linear, truncate at each end, sub-5-angled, somewhat few-striate, with the apex broad and sub-repand. Pappus persistent, brownish of 5 stout naked awns, to each of which there are 3–6 smaller divisions. Perennial herbs, resembling the *Eulygodesmia*."—GRAY, Proc. Amer. Acad. ix, 213.

† Regarded now by Dr. Gray (Syn. Fl. part 1, p. 3) as belonging to *L. splendens*, Willd.

bracts 5–8″ long, hardly exceeding the filiform, sigmoid, or curved pedicels; calyx-tube turbinate, half as long as the acute, ciliolate lobes, sinuses not appendaged; tube of the corolla 3″ long, exceeding the calyx; two inferior anthers hairy-tufted at the apex, and the others pubescent on the back Flowers violet-blue.—Sierra Blanca, Arizona, at 7,000 feet (797), and also collected by Dr. Loew on Quevelono Fork, Arizona.

Mr. Watson has kindly compared this for me with specimens in the Cambridge Herbarium, and I cannot doubt his conclusion, but I am bound to say the plant poorly accords with the description given in DC. Prod. 7, 373. See Fl. California, 1, p. 619, for the description of *Palmerella debilis*, var. *serrata*, Gray, a new and interesting genus of this order, and Plate XVI of this volume for its figure.

Specularia perfoliata, A. DC. (*Dysmicodon perfoliatum*, Nutt.)—Ash Creek, Arizona (314), at 5,000 feet.

Campanula rotundifolia, L.—Mount Graham, Arizona, at 9,250 feet (414); Colorado, Grant Post Office (752).

Campanula uniflora, L.—Grant Post Office, Colorado (751).

Campanula Langsdorffiana,† Fisch.—Differing from *C. uniflora*, L., in having an "obconic ovary"; calyx glabrous and the "lobes serrulate on the margins". The flower, too, is larger, *i. e.*, "1′ in diameter."

ERICACEÆ.

Vaccinium cæspitosum, Michx.—South Park, Colorado (741).

Arbutus* Menziesii, Pursh.—Leaves oval, serrulate, pale beneath and bright green above; racemes dense, minutely tomentose; corolla almost globular, white; berries dry, orange-colored, with surface granulate.—Santa Rita Mountains, at 7,050 feet altitude.

Arctostaphylos Uva-ursi, Spreng.—Mountain parts of Colorado (742). Said by the late accomplished author of Fl. Bor Amer. to be used by natives of the Northwest to weaken their tobacco; rather, I should say, to eke it out.

* Arbutus, Tourn.—Corolla gamopetalous; calyx free. Ovary 5-celled, raised on a disk. Stamens 10, included; anthers opening by pores and having 2 reflexed awns on the back. Placentas thick, on the inner angle of each cell. Berry rough, several seeds in each cell. The Madroño of the Southwest and Pacific slope, which, toward its southern range, becomes a large tree, but, as seen by me in Southern Arizona, is not over 20 feet high and 2 feet in diameter. Used by the Mexicans in the manufacture of stirrups, etc. Wood hard.

† Now assigned by Dr. Gray (Syn. Fl. part 1, p. 12) to *C. Scheuzeri*, Vill., var. *heterodoxa*, Gray.

ARCTOSTAPHYLOS TOMENTOSA, Dougl.—Shrub, 10° high; branchlets, younger petioles, and pedicels hispidly pubescent; leaves oval, thick, entire; flowers in short, close racemes, white, pale red, or red; calyx-lobes ciliate, reflexed after fall of the fruit; fruit pale yellowish-red, hairy when young (not warty), several-seeded. One of the several shrubs known as manzanita (or little apple) by the natives. The berries of this are used to form a cooling acid drink.—Mount Graham, Arizona, at 7,000 feet.

ARCTOSTAPHYLOS GLAUCA, Lindl.—"8–20 feet high, much branched"; leaves rigidly coriaceous, oblong to round, glaucous, sometimes slightly cordate; flowers flesh-colored; pedicels glandular-hairy, slender; fruit large, enclosing a 5-celled stone 6″ in diameter. Leaves twisting on their petioles become vertical.—Nevada and Utah.

PYROLA SECUNDA, L.—Shady ravines at Twin Lakes, Colorado, 10,500 feet (739).

PYROLA MINOR, L.—Alpine ravines, Colorado, at 10,500 feet (740).

PYROLA ROTUNDIFOLIA, L., var. ULIGINOSA, Gray.—Twin Lakes, Colorado, at 9,500 feet (738).

MONESES UNIFLORA, Gray.—Twin Lakes, Colorado (743).

PTEROSPORA ANDROMEDEA, Nutt.—Mount Graham, Arizona, at 9,000 feet (413).

PRIMULACEÆ.

PRIMULA PARRYI, Gray.—Mountain ravines, Colorado, at 10–12,000 feet (734).

PRIMULA ANGUSTIFOLIA, Torr. (Ann. N. Y. Lyc. 1, p. 34, t. 3, fig. 3).—Root thick; many fibrous rootlets; radical leaves obtuse, lanceolate to spatulate, entire, 6″–2′ long; scape 1–3′ high, naked or with a few bracts; calyx-tube cylindrical and with the obtuse, lanceolate, subulate teeth as long as the tube of the purple, sub-campanulate corolla (sometimes a little shorter); corolla 6–9″ wide; stamens inserted low down in the tube, the short filaments not more than one-fourth as long as the oblong anthers; stigma broadly clavate or globose.—Colorado (736); alpine.

PRIMULA FARINOSA, L.—South Park, Colorado (737).

ANDROSACE SEPTENTRIONALIS, L.—Colorado (356, 358, 359); Santa Fé (51). Collected also by Dr. Loew in Arizona, but locality not given.

Dodecatheon Meadia, L., var. latilobum (Gray, Fl. Cal. 1, page 467).—One of the best-marked varieties of this troublesome species, characterized by the "thinner, broader, undulate-toothed leaves, which are suddenly contracted into a petiole, and calyx-lobes about half as long as the capsule".—Colorado, New Mexico (72); Arizona. (Albino form from Mount Graham, at 9,250 feet, 403.) Collected also by Loew in Arizona, but no locality assigned. Nevada.

Steironema lanceolatium, Gray? (Proc. Amer. Acad. xii, 63).—Tonto Basin, Arizona, Dr. Loew. A mere fragment, nearer the above than any other species I am acquainted with.

Steironema ciliatum, Gray, *l. c.*—Utah.

OLEACEÆ.

Menodora* scabra, Gray (Amer. Jour. Sci. 2, 14, 44; Torr., Pacif. R. R. Rep. 7, t. 7).—Branching from a woody base, 6′–2° high, slightly hispidly-puberulent; leaves thickish, entire, margins somewhat revolute, 1–2″ wide and 3–10″ long; yellow flowers, in a corymb or panicle, the 7-10 setaceous lobes of the calyx somewhat exceeding the tube of the corolla, and also a little longer than the mature capsule.—Santa Fé, N. Mex. (60), and Southern Arizona (561).

Menodora scoparia, Engelm. (Fl. Cal. 1, p. 471). (*M. scabra*, var. *glabrescens*, Gray in Watson's Cat. Pl. Wheeler, 15.)—Differs from the above in being smoother, having ordinarily only 5–6 lobes to the calyx, and these not longer than the tube of the corolla.—Arizona.

Fraxinus viridis, Michx.—Arizona.

Fraxinus anomala, Torr.—Arizona.

Fraxinus coriacea, Watson, Amer. Nat. 7, 302.—"Leaflets 1–2 pairs, coriaceous, obovate or oblong, 1–2′ long, truncate or rounded at the apex

* Menodora, H. B. K.—"Calyx with a short and turbinate tube, and 5-14 narrow lobes from its truncate border. Corolla campanulate, funnel form or almost rotate, mostly 5-lobed; the lobes imbricated in the bud. Stamens 2, sometimes 3, on the tube of the corolla: anthers oblong or linear. Style slender; stigma obtuse or somewhat 2-lobed. Capsule didymous, mostly 2 parted, membranaceous at maturity, circumcissile, the upper part of each lobe falling off as a lid leaving the scarious membranaceous base. Seeds 2 (or rarely fewer in each cell), ascending, large and with a fleshy, or when dry a spongy outer coat, destitute of albumen.—Low and undershrubby or nearly herbaceous plants; with sessile leaves, not rarely alternate and terminal, mostly somewhat cymose flowers, which are rather showy."—Fl. Cal. 1, p. 471.

or acutish, attenuate or abruptly contracted at base, sparingly toothed, mostly rather long petiolulate, glabrous, or, with the petioles, pubescent when young; fruit 1′ long, terete at base, widening into an oblong, obtuse wing, calyx persistent.—Ash Meadows, Nevada, and also collected by Dr. Bigelow on the Mexican Boundary Survey, at Devil's Run Cañon, but not mentioned in the report. A stem of twelve years' growth, 1½ inches in diameter, has a smooth grayish brown bark."—Not having access to specimen, I have taken the above from Mr. Watson in Cat. Pl. Wheeler, p. 15. Species reduced by Dr. Gray in Syn. Fl. N. Am. p. 74, to a variety of the following.—PLATE XXII.

FRAXINUS PISTACIÆFOLIA, Torr., *forma tomentosa*.—Tomentose, leaflets 5, almost sessile, lanceolate, irregularly serrate, tomentose, especially beneath; samara 1′ long, seminiferous portion terete, 1″ in diameter, 6″ long, equalling the narrow, lanceolate wing. Very variable in shape and hairiness of the leaves, so much so that, in describing it a second time in the Botany of Whipple's Expedition, Dr. Torrey changed the name from *F. velutina*, as it appeared in Emory's report, to the present name.—Ash Creek, Arizona, at 5,000 feet altitude (302). Grows to be 20 feet high, with a diameter of 18 inches.

FORESTIERA* NEO-MEXICANA, Gray, Proc. Amer. Acad. xii, 63.—Thickish leaves, lanceolate to oblong-spatulate, acute or obtuse, usually irregularly serrate; (staminate flowers not seen,) pistillate flowers in fascicles of from 4–7; immature drupe oval, blue and glaucous; young seed longitudinally wrinkled. A much branching shrub, 8 feet high.—New Mexico (108).

APOCYNACEÆ.

APOCYNUM ANDROSÆMIFOLIUM, L.—Twin Lakes, Colorado (45).

APOCYNUM CANNABINUM, L.—Deer Spring, Arizona (191).

*FORESTIERA, Poir.—Flowers diœcious or polygamous. Calyx, when present, small, unequally 5–6-cleft. Corolla none, or rarely 2–3 petals. Stamens 2–4, with shortish filaments; anthers ovate, subextrorsely dehiscing. Ovary 2-celled; style delicate, stigma thickened or 2-cleft; ovules two in either cell, suspended from the apex of the cell. Drupes ovoid or subglobose. Endocarp coriaceous or thin. Seeds 1–2, pendulous; testa membranaceous; albumen fleshy; cotyledons flat, short radicle superior.—Smooth or hairy shrubs. Leaves opposite, entire or serrulate, deciduous, often fascicled in the axils. Flowers small, very like those of *Fraxinus*, section *Fraxinaster;* appearing before the leaves from the nodes of the branches, fascicled or short racemose.—BENTHAM & HOOKER.

MACROSIPHONIA* BRACHYSIPHON, Gray. (*Echites brachysiphon*, Torr. Bot. Mex. Bound. 158, 43.)—Low, branching from a woody base; branches puberulent; leaves opposite, entire or wavy, lanceolate to oval, usually acute; flowers yellowish-white, 1½–2′ long; throat somewhat exceeding the cylindrical tube, 1½′ across the expanded oval lobes; follicles (mature) 3–6′ long, 2–3″ wide, puberulent; coma rusty-brown, exceeding the seed.—Limestone soils, Southern Arizona, at 5–6,000 feet altitude (646, 497).

ASCLEPIADEÆ.

BY DR. GEORGE ENGELMANN.

PHILIBERTIA† CYNANCHOIDES, Gray, Proc. Amer Acad. 12, 95. Synops. 87. (*Sarcostemma cynanchoides*, Decaisne in DC. Prod. 8, 541. *S. bilobum*, Torr. Bot. Mex. Bound. 160.)—Tall, climbing, glabrous or glabrate; leaves from deeply cordate to sagittate or hastate, abruptly cuspidate or short-acuminate, 1–2½′ long; pedunele 15–25-flowered; slender pedicels much longer than the flowers; corolla whitish, nearly half an inch wide; lobes acutish, somewhat ciliate, crowns separated by a very short column.—Cienega, near Tucson, Ariz. (566), Rothrock, 1874, and to Western Texas.

PHILIBERTIA LINEARIS, var. HETEROPHYLLA, Gray, *ib.* (*Sarcostemma heterophyllum*, Engelm Bot. Mex. Bound. 161.)—Glabrous or upward pubescent; leaves 1–2′ long, 1–2″ wide, some tapering into a petiole, some with a rounded, others with a dilated or auriculate-cordate base; corolla 6″ wide, yellowish, purplish, or whitish, lobes ovate, crowns contiguous.—

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*MACROSIPHONIA, Muell. (Arg.).—Calyx 5-cleft, with many small glands inside the base; lobes narrow. Tube of the corolla long, cylindrical; throat short, campanulate or sometimes broader and longer than the tube; no scales. Corolla-lobes 5, broad, often crisped. Stamens attached to the highest part of the tube, anthers conniving around the stigma and attached to it by a little below the middle; anther-cells produced into blunt appendages below. Scales of the disk 5, of which 3 are free and 2 united. Ovary of two distinct carpels; style filiform; stigma thickened coriaceous, 5-ribbed, with the base produced into 5 reflexed lobes, acutely and somewhat 2-lobed apiculate; ovules numerous in either carpel. Follicles straight, terete, continuous or sub-torulose. Seeds oblong, crowned with a long (and at length deciduous) coma. Albumen thickish; cotyledons oblong; radicle short.—Undershrubs, erect, simple or branched. Leaves opposite or whorled, with the margin often undulate-crisped. Flowers in a terminal raceme or at length pseudo-axillary, few or solitary, on very short pedicels, white, yellow, or scarlet.—BENTHAM & HOOKER.

†PHILIBERTIA, H. B. K.—Corolla rotate, deeply 5-parted; crown double, the exterior or membranaceous ring adnate to the base of the corolla, the interior of 5 (in ours tumid, hoodlike) scales adnate to the base of the very short column; pollinia suspended; follicles smooth, acuminate.—Perennial, more or less twining herbs.—(*Sarcostemma*, H. B. K. Bot. Mex. Bound, etc., not R. Br.)—BENTH. & HOOK. Gen. 2, 750. GRAY, Proc. Amer. Acad. 12, 95.

Water-hole near Tucson, Ariz., Rothrock, 1874 (700). From Western Texas to Southern California and into Mexico.

ASCLEPIODORA* DECUMBENS, Gray, Proc. Amer. Acad. 12, 66. (*Anantherix decumbens*, Nutt.; *Acerates decumbens*, Decaisne, Watson, Bot. King.)—Santa Fé, N. Mex. (283), Rothrock, 1874. From Arkansas to Texas, New Mexico, and Utah.

ASCLEPIAS TUBEROSA, L.—Willow Spring, Arizona (200), Rothrock, 1874. Exactly like the common form of the States. Perhaps the most western locality of this beautiful species.

ASCLEPIAS SPECIOSA, Torr. Ann. Lyc. N. Y. 2, 218; Watson, *l. c.* 282.—Willow Spring, Arizona (249), Rothrock, 1874.

ASCLEPIAS INVOLUCRATA, Engelm. Bot. Mex. Bound. 163; Gray, Syn. 94.—Minutely pubescent when young, at last glabrate; several weak, spreading stems from a stout root less than a span long; leaves opposite or alternate, lanceolate-linear, tapering, on short petioles, the broader ones with a roundish, the others with a tapering base, the uppermost involucrating the mostly solitary, sessile, or short-peduncled umbel, and commonly overtopping it; flowers greenish with purple; ovate hoods rather longer than the anthers, the short incurved horn slightly exserted from about their middle; pods ovate, acuminate, smooth, pubescent.—Algodones, N. Mex. (78), Rothrock, 1874; also in Arizona and adjacent Mexico.

ASCLEPIAS VERTICILLATA, L., var. SUBVERTICILLATA, Gray, Proc. Am. Acad. 12, 71; Syn. 97.—Taller and stouter than the usual form, with leaves 3–5′ long, opposite or ternate; peduncles alternate all along the stem, many times longer than the pedicels; flowers rather larger than those of the ordinary form.—Algodones, N. Mex. (77), Rothrock, 1874. Very similar to Fendler's No. 694 from the same region. It approaches nearer to *A. Mexicana* than to any of our varieties, but is readily distinguished by the scattered (not subterminal) umbels, the flat leaves, with slightly revolute margins, etc. The roots of all the forms of *verticillata* are fascicled, the

*ASCLEPIODORA, Gray, Proc. Amer. Acad. 12, 66; Syrops. 88. (*Anantherix*, in part, Nutt.; *Acerates*, in part, Decaisne and others.)—Corolla rotate-spreading, afterwards closed; hoods inserted over the whole (short) column, spreading and assurgent, sac-shaped, upward 2-celled by a salient crest. Anther-wings corneous, narrowed at base, angulate above the middle; pollinia dependent.—Stout, low, perennial herbs, with usually scattered leaves and large greenish flowers in subterminal umbels.

lower part of the rootstock decaying, the remaining part throws out annually numerous strong fibres. The root of *A. Mexicana* ought to be compared with it.

GENTIANEÆ.

By Dr. George Engelmann.

Erythræa calycosa, Buckley; Gray, Synops. 113.—Simple or branching from an annual or biennial base; erect stems quadrangular-winged; leaves linear-lanceolate (about 1′ long), lower ones broader, as long or longer than the internodes; panicle rather contracted, loose-flowered; pedicels as long as or longer (or the upper ones shorter) than the large flowers (8–10″ in diameter, rose-colored, with yellow centre); calyx about the length of the flower-tube; lobes of corolla oblong, acutish, often denticulate, scarcely shorter than their tube; seeds small, 0.3–0.4^{mm} long.

In the Gila Valley, Rothrock, 1874 (325), and southeastward into Mexico, Gregg, etc.—Stems 1–1½° high, the tallest of our species; leaves 1–1½′ long, distinguished by its large bi- or tri-colored flowers with acutish lobes. *E. venusta*, Gray, with which it has been confounded, is a smaller plant with larger deeper-colored flowers, broader obtuse corolla-lobes, and usually longer anthers and larger seeds.—The anthers of the different species of *Erythræa* are of different shape and size, from orbicular and oval to oblong and linear and ½–4 or 5^{mm} in length; all become at last spirally twisted after they have shed their pollen, the longer more conspicuously so, the shorter much less. The stigmas of this genus have often been misunderstood, probably because mostly observed in dried and pressed specimens. They are never capitate or funnel-shaped, but always bilobed. Before maturity, they remain closed, and only after the anthers have shed their pollen do both halves separate and spread out, just as the Gentians behave. In the form of the stigma, I find valuable characters for grouping of the species, and especially for the distinction of the American ones from those of the Old World. The stigmas of the former are flabelliform and broader than long; those of the latter are orbicular-ovate or oblong to linear; shortest in *E. spicata* and *linearifolia*, and longest in *major*, where they are twice as long as wide, and in *maritima*, in which the length is 3 or 4 times

as great as the width. *E. Australis* from Australia, as well as *Cicendia* from Europe, have stigmas like the American species, but *E. Chilensis* (at least a specimen collected by Ochsenius in Valdivia, which I refer to that species) differs from all the others in having elongated, cuneate, emarginate stigmas.

The seeds of *Erythræa* are identical with those of a large group of *Gentianeæ*, which comprise perhaps all of Grisebach's *Chironieæ* and *Chloreæ*, being very numerous and very small, from $\frac{1}{5}$ to scarcely more than $\frac{1}{2}^{mm}$ in the longer diameter, and, when fully mature, globose or oval, with their surface favose-reticulate.

The North American genera belonging to this group may be arranged thus:

1. Stamens inserted in the tube: Erythræa. Eustoma.
2. Stamens inserted in the throat: Sabbatia. Microcala.

Chlora, Chironia, and Sebæa of the Old World also belong here.

My investigations have convinced me that the genus *Cicendia*, or at least its typical and original species, *C. pusilla*, is nothing but a reduced form of *Erythræa*, distinguished from it only by its small oval anthers, less than 0.5^{mm} in length, too short to twist much, but still, when drying, sometimes twisting a little. Its stigma is by no means capitate, but regularly bi-lamellate, and, much like that of the American species, triangular-flabellate, and broader than long. The flowers are 4-parted, which often occurs in genuine species of *Erythræa;* seeds 0.4^{mm} long, large for the size of the plant. It will have to bear the name *Erythræa pusilla.*

Erythræa Douglasii, Gray, Fl. Calif. 1, 480; Syn. 113.—Slender, a span to a foot high, loosely and paniculately branched, usually sparse-flowered; leaves from oblong to linear, acutish; flowers on strict, slender pedicels, 4–5″ wide; lobes of the pale pink corolla obtuse, much shorter than the tube; anthers usually only 1^{mm} long, style short, stigma about 1^{mm} wide; seeds sub-globose, 0.4^{mm} in diameter.—Arizona, Utah, and northwestward to Oregon. This plant has been confounded by Mr. Watson with his *E. Nuttallii*, which, however, is a smaller and more leafy plant, with larger flowers and much larger seeds (0.65^{mm} long), but much smaller stigmas.

GENTIANA* HUMILIS, Stev. Griseb. in DC. Prod. 9, 106. Engelm. Trans. Acad. St Louis, 2, pl. 9, figs. 1–5. Gray, Syn. 120.—Biennial, with large, broadly oval, rosulate, white-margined basal leaves, and few or many ascending stems of a pale yellowish-green; cauline leaves small, linear-oblong; flowers single, terminal; *corolla greenish or whitish*, 4–6″ long, tubular, with acute lobes, and short, notched folds; anthers oval, introrse; *capsule clavate-obovate, on a long stipe*, usually much exceeding the corolla; seeds oblong.

Wet, grassy spots in the higher Rocky Mountains; also in Asia. The long, protruding capsules (trumpet-shaped when open), together with its pale, sickly look, give the little plant a very curious appearance.

GENTIANA PROSTRATA, Hænke; Griseb. *l. c.* Engelm. *l. c.* figs. 9–14. Gray, Syn. 120.—Annual, small, weak, 1–2′ high, with horizontal or decumbent branches; leaves only 2–3″ long, ovate, green with narrow white margins; *flowers azure-blue*, 4-parted, terminal on the branches, 5–6″ long (or in luxuriant specimens sometimes larger); lobes ovate-lanceolate; appendages half as long, similar or sometimes notched; anthers oval,

* The presence or absence of folds or plaits between the lobes of the corolla and the mode of attachment of the anthers to the filament separate the Gentians into two large and very natural sections, already recognized by old authors: *Gentianella* (Borkhausen), Gray, has a corolla without folds and the anthers versatile; *Pneumonanthe* (Necker), Gray, has a corolla with folds between the lobes and fixed anthers. It will not be useless to explain the term *versatile* in respect to anthers, as many seem to misunderstand it, so that they speak of versatile anthers as accidental and unconnected with a physiological process. The fact is that in *Gentianella* the anthers are introrse in the bud and after it first opens; but as soon as the flower is fully expanded (generally toward the middle of the day) the anthers gradually assume a horizontal position (the notched base raised and turned toward the as yet immature and closed stigma), open the cells upward, and begin to shed their pollen. Toward evening, the now effete anther is turned over backward, and on the next morning we find it hanging on the back of the filament, the notched lower end turned up and the empty cells directed outward. Thus in about twelve hours it has described an almost complete circle. In my figures of Gentians in the Transactions of the Academy of Saint Louis, vol. 2, pl. 7, 8, 9, and 11, versatile anthers are erroneously represented as turning indiscriminately outward or inward. This is a mistake, as the above account of the living action of the anthers shows. In the figures of *G. humilis* and *prostrata*, pl. 9, the anthers are also figured as versatile in that unnatural manner, while in these species they are constantly erect and introrse, as well before opening as when effete.

In *Pneumonanthe* the anthers remain fixed in two forms. In one section, comprising mostly smaller plants, with smaller flowers (*G. prostrata, verna, Altaica, humilis, utriculosa*, etc.), they are introrse. In another section, the true perennial large-flowered *Pneumonanthes*, to which we must add also an annual, *G. Douglasiana*, and the European *G. cruciata*, they are extrorse. In the genera *Halenia*, *Pleurogyne*, *Swertia*, and *Frasera*, all represented by plants collected in these expeditions, we find the same arrangement of versatile anthers as in *Gentianella*. It therefore seems proper to enumerate, first, the Gentians with fixed anthers, and next those with versatile anthers, and then, joining them, the other genera with similar versatile antheral arrangement.

introrse; *capsule linear-oblong, short-stipitate*, enclosed in the corolla; seeds oblong.—Alpine regions of the Rocky Mountains, also in Asia, and rare in Europe, where it is said to have usually 5-parted flowers.

Gentiana frigida, Hænke. Griseb. *l. c.* 111. Gray, Syn. 120.—Cespitose stems, 1–5′ high, with fibrous roots; leaves linear to spatulate, thickish, pale, 1–3′ long, their bases forming a long sheath; calyx half as long as the corolla, with subulate lobes and, frequently, a cleft tube; flowers 1–3, crowded on top, funnel-shaped, 1½′ long, yellowish or greenish-white, spotted with red and brown; lobes broad-triangular, acute; reddish plaits wide, oblique, undulate-crenulate, almost entire; anthers free; seeds broad, narrowly winged, with crested ridges.

Springy places, in the alpine regions of the Rocky Mountains, and in Asia; very rare in Europe.—A very handsome plant in the color of its flowers. Its mode of growth is entirely different from any other of our species. The flowering stems bear in the axils of their lowest leaf-pair, within its long sheath, or breaking through it, leaf-buds which in the succeeding year produce flowering stems, while the base of the old stem withers away. The roots are therefore only of one year's growth, thin and filiform, never thick, as those of most other *Pneumonanthes*, nor is there a real caudex.

Gentiana Parryi, Engelm. Trans. Acad. St. Louis, 2, 218, pl. 10. Gray, Syn. 121.—Few ascending stems from thick fasciculate roots, about a span high; leaves glaucescent, thickish, about 1′ long, broadly ovate to oblong-lanceolate, with a sheathing base, especially in the lower ones; the uppermost boat-shaped and keeled, involucrating the single or few clustered flowers, concealing the calyx and often almost equal to the large deep-blue corolla; lobes of calyx linear, short, sometimes almost obliterated, shorter than the campanulate often once- or even twice-cleft tube; corolla 1½′ long, somewhat ventricose, its lobes short, broad, acutish, not much exceeding the narrow deeply 2-cleft appendages; anthers free; seeds linear-lanceolate, wingless.—Moist grassy places in the alpine and sub-alpine regions of Colorado and Utah.

Gentiana affinis, Griseb. *l. c.* 114. Gray, Syn. 122.—Many stems, from a stout rootstock, with thick fasciculate roots, a span to a foot high,

mostly ascending; leaves from oblong to lanceolate or linear; flowers small for the section, 1–1¼′ long, usually clustered in the axils of the upper leaves, rarely few; bracts lance-linear; calyx-lobes linear, unequal, usually shorter than their sometimes cleft tube; lobes of the blue corolla acute, plaits bifid, anthers unconnected; sessile stigmas lanceolate; seeds narrowly, or sometimes more broadly, winged.

Wet, grassy places in the Rocky Mountains of Colorado and Utah. The numerous thin seeds are borne on the whole inner surface of the capsule, which thus not only has the function of a placenta, but really seems to be nothing but a thin, membranaceous expansion of the placentæ themselves, forming a free sac within the capsule, which originates from the commissures of the carpels, and remains attached to them only, and is at last otherwise entirely unconnected with the walls of the capsule. It is probable that all the *Pneumonanthes* with ovules from the entire inner surface of the capsule have this structure, and that in the others the ordinary arrangement of commissural placentæ prevails.

Gentiana serrata, Gun. Fl. Norveg. 10. Gray, Synops. 117. (*G. detonsa*, Rottb. Fries, Gray's Manual ed. 5th, 387.)—Low, simple specimens, a few inches high, with single flowers, 1–1½′ long. Mount Graham, Ariz. (751), at 9,000 feet altitude.

The Norwegian specimens of this plant in my herbarium have much smaller flowers than ours and much smaller seeds. The "scales" which roughen the surface of the seeds prove, when moistened, to be transparent vesicles, single protruding cells of the epidermis. In the Norwegian form, these vesicles are small, oblong, or cylindric; in the American specimens, they are much larger and mostly hemispherical; in the allied *G. crinita*, I find them large and oblong.

Gentiana barbellata, Engelm. Trans. Acad. St. Louis, 2, 216, pl. 11.—Has thus far been found only in the mountains of Colorado, near the timber-line, and is a very distinct species, which can in no way be confounded with *serrata* or *simplex*. I have already, in the first account of this species, given the diagnostic characters, and have also stated that it is the only perennial one of the section *Crossopetalum* in America, somewhat allied

to the European *G. ciliata*, also a perennial species, which used to be claimed as an annual; *barbellata*, however, has seeds similar to those of *serrata*, though much smaller, while *ciliata* has the winged seeds of *simplex*, and has an indefinite number of leaves. I have since had the opportunity of studying *barbellata* in the mountains of Colorado, and found that it possesses a creeping, filiform rhizoma, 2–3 inches below the surface, from which at intervals filiform stems arise. These bear, at their thickened upper end, where they reach the surface of the soil, an undeveloped terminal bud of indefinite growth, and lateral annual flowering stems, the scars of which, enveloped by withered leaf-bases, can be traced sometimes for five or six years back. The vegetation of the plant is accomplished in the following manner.—Each season the terminal bud developes two pairs of basal leaves; from the axil of one of the outer leaves, the single flowering branch originates. Inside of the two leaf-pairs just mentioned, we find a third and a fourth pair undeveloped, about half an inch long, which are to grow into the basal leaves in the following season; and within these the four leaves of the next succeeding season, now only half a line long, are already preformed. The flowering branch, usually 3 or 4 inches high, normally bears one pair of leaves in the middle, and a second involucral pair just below the almost sessile flower; the four sepals are opposite these four leaves, and the four corolla-lobes alternate with the sepals, and so on. In the axil of one of the third pair of basal leaves preparing for next year, usually alternating with, or sometimes opposite to, the present flowering branch, the bud of next year's flowering apparatus is already four lines long; it shows plainly the two pairs of leaves and the calyx, and, in a very rudimentary state, also the corolla. Thus each year's vegetation exhibits at the flowering period (August and September), on the primary axis, two pairs of leaves for the present, two pairs for the next, and two for the third year, a secondary axis with two leaf-pairs and the flower, and another preformed secondary axis with the rudiments of the same organs for the next year. No other Gentian has, as far as I know, such a typical growth, with the regular preformation of all the organs, but we find the same among other plants in other families, a striking example of which is furnished by our *Nelumbium*. The regularity in our Gentian is not as absolute as in *Nelumbium*; for occa-

sionally two flowering branches are found on the same plant, or three pairs of leaves in place of two, or, very rarely, the upper involucral leaves bear one or even two axillary flowers.

GENTIANA WISLIZENII, Engelm. *l. c.* pl. 7; Gray, Syn. 119.—Annual, erect, a foot or less high, with the habit and the many-flowered thyrsoid paniculate inflorescence of the next; leaves from lanceolate to ovate, 1′ or less long, with an obtuse or subcordate base; calyx of barely half the length of the tube of the corolla, with very small teeth, its membranaceous tube cleft, and often, in age, dejected; corolla pale purplish, 4–5″ long, acute lobes fringed above the base; capsule linear; seeds subglobose

White Mountains of Arizona, Rothrock (799), in 1874. This is the only known locality within our flora of this rare plant, which was discovered by Dr. Wislizenus over thirty years ago in the mountains west of Chihuahua.

GENTIANA AMARELLA, L., var. ACUTA, Hook. f. Gray, Syn. 118. (*G. acuta*, Michx.).—Annual, 2–20′ high; stems wing-angled, usually much branched; lowest leaves obovate, petiolate, upper ones lanceolate sessile; inflorescence paniculate or strictly thyrsoid, with shorter erect or in some forms with elongated patulous pedunceles; calyx deeply 5-cleft; herbaceous lobes lance-linear, somewhat unequal, often as long as the tube of the bluish-purple corolla, the lobes of which are oblong, obtusish, beset at base with copious (or in the diminutive alpine form, few) setæ: sessile capsule linear; seeds subglobose.

Grassy places in the mountains of Colorado and northeastward. The true European *G. Amarella* has usually 4-parted flowers

HALENIA ROTHROCKII, Gray, Proc. Amer. Acad. 11, 84; Syn. 127.—Annual, a span or two high, loosely flowered; lower leaves small, spatulate, those of the stem distant, lance-linear, the uppermost closely approaching subverticillate; flowers cymose-subumbellate, on slender peduncles, often in sevens, nearly 6″ long, bright yellow, ovate, acute lobes a little longer than the campanulate tube, the five spurs curved, horizontal or ascending, half as long as the corolla; stamens from the throat of the tube; anthers versatile; seeds subglobose-ovate

On Mount Graham, at 9,000 feet altitude; in flower in September,

Rothrock (733), in 1874. Evidently allied to three Mexican species which have also umbelliform cymes; the innermost involucral leaves bear single flowers, the outer ones usually two, and a later secondary flower is borne on a shorter peduncle behind a primary one. This is the only Western species yet discovered.—PLATE XXI. Natural size. 1. Flower, 5 diameters. 2. Mature capsule, cross-section, about 5 diameters. 3. Vertical section through flower, about 10 diameters.

PLEUROGYNE* ROTATA, Griseb. Gray, Syn. 124. (*Swertia rotata*, L.).—Stems 2–10′ high, the smallest ones one-flowered, others thyrsoid-branched, many-flowered; leaves lance-linear; sepals linear, acute, as long as the milk-white ($\frac{3}{4}$–1′ wide) corolla, acute at both ends

Moist, grassy places in Colorado, sometimes in large patches, and then disappearing again for years. The spreading flowers of this and the next two genera afford the best opportunity of observing the action of the versatile anthers as they slowly turn from the introrse to the horizontal, and then to the extrorsely reversed position, as explained above. The glands on the base of the corolla-lobes are distinct enough, but the surrounding scale is apparently not, as it is ignored by many botanists; I have seen it variable, longer or shorter, but always present; when fully developed, it forms a complete crested or fringed funnel The stigma of this plant is most peculiar, formed as it is directly on the commissure of both carpels and representing a broad stigmatic line commencing about $\frac{3}{4}''$ below the non-stigmatose apex, running down the sides to the same distance above the base, so that we have here a two-carpellary ovary with two lateral, but without any apical stigma. This line is beset with elongated stigmatic cells or papillæ about 0.1^{mm} long and $\frac{1}{6}$ as wide. At the proper time, numerous pollen-grains are found adhering to the stigma, many of them developing their tubes. The seeds I have been able to examine were not fully matured, but such as they are, they appear oval-oblong, not flattened nor margined, but slightly angular and nearly 0.5^{mm} in the longer diameter

* PLEUROGYNE, Eschsch.—Erect annuals of cold or alpine regions, with opposite leaves, few or numerous whitish flowers in a fastigiate'y much-branched panicle; corolla rotate, often 4-parted, in our species with a pair of nectariferous pits at the base of the lobes surrounded by a funnel-shaped crest or a fringed scale; stamens versatile; ovary lanceolate, bearing the linear stigmas decurrent down the sides on the sutures; ovules abundant on the broad placentæ on both sides of the sutures; capsule oval, compressed; seeds oblong, smooth.

SWERTIA * PERENNIS, L., Gray, Syn. 124.—A span to a foot high; lowest leaves oblong or obovate, 2–4′ long; upper few and narrow, sessile; flowers 1′ wide.—Colorado and Utah mountains, in boggy places; also in Europe and Asia.

FRASERA SPECIOSA, Dougl. in Griseb. Gent. 329. Hook. Fl. 2, 66, tab. 153; Gray, Syn. 125.—Biennial; stem stout, 2–6° high, very leafy; leaves in fours and sixes, nervose, the radical and lower cauline ones linear-oblong, 6–10′ long, acutish or obtuse, the upper narrower and shorter; flowers numerous, in a long leafy thyrsus; lobes of the greenish-white (rarely bluish) dotted corolla oval-oblong, acutish (6″ long), bearing a pair of contiguous and densely long-fringed glands about the middle, and a distant transversely inserted and setaceously multifid scale-like crown near the base; anthers versatile; capsule compressed contrary to the deep boat-shaped valves; oblong seeds flat, margined.—Willow Spring, Arizona, Rothrock (251), in 1874; Colorado, Wolf (790), in 1873. A mountain species, found in the Rocky Mountains and westward to California and Oregon.

POLEMONIACEÆ.

BY PROF. T. C. PORTER.

PHLOX LONGIFOLIA, Nutt. (Gray, Proc. Am. Acad. 8, p. 255; Watson in King's Rep. 5, p. 260).—Nevada, 1871, 1872, Watson's Rep.; Boulder, Colo., 1873, Loew (680); Central Colorado, 1873, Wolf (681).

PHLOX LONGIFOLIA, Nutt., var. STANSBURII, Gray.—Arizona and Nevada, 1871, 1872, Watson's Rep.

PHLOX NANA, Nutt. (Pl. Gamb. p. 4; Gray, Proc. Am. Acad. 8, p. 256; Watson, *l. c.* p. 464).—Santa Fé, N. Mex., June, 1874, Rothrock (8).

PHLOX DOUGLASII, Hook. (Gray, *l. c.* p. 254; Watson, *l. c.* p. 260).—Nevada and Arizona, 1871, 1872, Watson's Rep.

PHLOX CÆSPITOSA, Nutt (Gray, *l. c.* p. 253; Watson, *l. c.* p. 259).—Nevada and Utah, 1871, 1872, Watson's Rep.; South Park, Colorado, July, 1873, Wolf.

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* SWERTIA, L.—Single-stemmed perennials; leaves occasionally alternate, the lowest ones tapering into an elongated, margined petiole; inflorescence thyrsoid; flowers blue; corolla rotate, with a very short tube; nectariferous pits at the base of its lobes crested with a fringe; anthers versatile; seeds flat, winged.

COLLOMIA LINEARIS, Nutt (Watson, *l. c.* p. 261).—Utah, Watson's Rep.; South Park, Colorado, July, 1873, Wolf (686, 687).

COLLOMIA GRACILIS, Dougl. (Watson, *l. c.* p. 262).—Denver, Colo., June, 1873, Wolf (354).

COLLOMIA GILIOIDES, Benth. (*Gilia divaricata*, Nutt. Pl. Gamb. p. 4; Watson, *l. c.* p. 464).—Willow Spring, Arizona, July, 1874, Rothrock (233).

COLLOMIA CAVANILLESIANA, Don. (Gray, *l. c.* p. 260; Watson, *l. c.* p. 465).—Big Dry Fork, Arizona, 1873, Loew (678); Camp Grant, at 5,250 feet elevation, Rothrock (439); Chiricahua Mountains, August 1, 1874, Rothrock (536); Black River, at 4,500 feet elevation, September, 1874, Rothrock (788).

COLLOMIA LONGIFLORA, Gray (Proc. Am. Acad. 8, p. 261; Watson, *l. c.* p. 465).—San Francisco Mountains, Arizona, 1871, 1872, Watson's Rep.; Denver, Colo., June, 1873, Wolf (675, 677); deserts of New Mexico, 1873, Loew; Camp Bowie, Ariz., August, 1874, Rothrock (412); Deer Spring (180).

COLLOMIA AGGREGATA (*Gilia aggregata*, Spreng.; Watson, *l. c.* p. 269).—Arizona, Nevada, and Utah, 1871, 1872, Watson's Rep.; Arizona, 1873, Loew (305, 744); Blue River, Colorado, June, 1873, Wolf (745); Rocky Cañon, Arizona, July, 1874, Rothrock (275); White Mountains, Arizona, at 9,000 feet elevation, September, 1874, Rothrock (810).—An examination of a goodly number of specimens of *Gilia aggregata*, Spreng., from different stations in the Rocky Mountains and California, brings to light a character in the species which has been overlooked,—*the unequal insertion of the stamens.* The degrees of variation in this respect are remarkable and so gradual as to rule out the supposition of dimorphism. In the extreme cases, they are included, on the one side, in the tube of the corolla and very unequally inserted at points wide apart, from the base upward, whilst, on the other, they are crowded toward the throat and more or less exserted. Then, the insertion sometimes is, or rather, perhaps, appears to be, equal. In a specimen of this kind from California, it would be hard to declare that the filaments in some of the flowers do not start out from the same horizontal line, whilst in other flowers on the same stalk their insertion is decidedly unequal. Now, as the main character which separates *Collomia* from *Gilia* is the unequal inser-

tion of stamens, I have ventured to transfer this species to the former genus, where it naturally falls into Dr. Gray's section *Phloganthea*, and forms a link of transition between the two genera. It may be here remarked that the character of *Gilia* given by Bentham and Hooker (Genera, 2, p. 822), "*semina nunquam spirillifera*", is evidently an oversight, since Dr. Gray, whose elaboration of the genus is adopted in full, restricts it to the species with opposite and palmately-cleft leaves.

GILIA NUDICAULIS, Gray (Watson, *l. c.* p. 264).—South Park, Colorado, 1873, Wolf.

GILIA NUTTALLII, Gray (Watson, *l. c.* p. 264).—Oro City, Colo., July, 1873, Wolf (682); Arizona, 1873, Loew (164 *a*).

GILIA PUNGENS, Benth.—Denver, Colo., June, 1873, Wolf; Nevada, 1871, 1872, Watson's Rep.

GILIA DEBILIS, Watson (Am. Naturalist, 7, p. 302; Report for 1871, 1872).—Stems short and slender, 1–2 inches high, leafy above; pubescence minute or hirsute; leaves alternate, ½–1 inch long, oblong, attenuate into a short petiole, entire, or some of them broader and 3-lobed; bracts entire, resembling the leaves, twice longer than the calyx; flowers nearly sessile; calyx with ovate-triangular teeth, shorter than the tube; corolla funnel-form, 8 lines long, with elongated tube and deeply-lobed limb, light purple; stamens upon the throat exserted; capsule 1 line long, the cells 1-seeded; seeds without mucilage or spiricles.—Southern Utah, 1871, 1872.—PLATE XIX, FIG. A. Natural size. Figure 1. Flower, and, 2, Corolla split open, each enlarged about 5 diameters.

GILIA DEMISSA, in the same plate, not being collected by the Expedition, is not described. See Gray, Syn. Fl. N. Am. part 1, p. 137.

GILIA DENSIFOLIA, Benth. (Watson, *l. c.* p. 468).—A foot or two high, from a perennial root; stems virgate from a woody base, leafy to the top; leaves rigid, linear, laciniate-pinnatifid or incised, the short lobes few or several, subulate; flowers numerous, in a compact head; corolla over half an inch in length, violet-blue, two or three times the length of the calyx (the lobes three lines long); anthers linear-sagittate; ovules several (Gray, in Bot. Cal. 1, p. 495).—Nevada, 1871, 1872.

Gilia filifolia, Nutt., var. diffusa, Gray (Watson, *l. c.* p. 267).—Nevada, 1871, 1872.

Gilia congesta, Hook. (Watson, *l. c.* p. 268).—Gray's Peak, Colorado, at 10–12,000 feet elevation, July, 1873, Wolf (748, 749).

Gilia pinnatifida, Nutt. (Watson, *l. c.*, p. 469).—Denver, Colo., June, 1873, Wolf (746).

Polemonium humile, Willd. (Watson, *l. c.* p. 470).—Utah, 1871, 1872; Georgetown, at 8,500 feet elevation, and Gray's Peak, Colorado, at 12,000 feet elevation, 1873, Wolf (685).

Polemonium cæruleum, Linn. (Gray's Man. p. 371).—Central Colorado, at 10–11,000 feet elevation, July, 1873, Wolf (683).

Polemonium cæruleum, L., var. foliosissimum, Gray (Watson, *l. c.* p. 272).—Utah, 1871, 1872.

Polemonium confertum, Gray (Watson, *l. c.* p. 272).—Utah, and Belmont, Nev., 1871, 1872; Central Colorado, at 12,000 feet elevation, July, 1873, Wolf (684).

HYDROPHYLLACEÆ.

Phacelia* circinata, Jacq. f.—Loew, Arizona. A widely distributed and polymorphic species.

Phacelia crenulata, Torr.—Nevada.

Phacelia glandulosa, Nutt.—Annual, viscidly pubescent, somewhat glandulose; leaves bi-pinnately parted; lobes short and obtuse; seeds delicately impressed-punctate; calyx-lobes oblong, spatulate, obtuse; placentæ 2-ovuled; seeds vertical.—Agua Azule, N. Mex., 6,700 feet altitude (131). *P. Popei*, Torr. & Gray, Pac. R. R. Rep. 2, p. 172, t. 10, is simply a less hairy form, having the lobes of the corolla entire. Colorado, along the Arkansas (99).

Var. Neo-Mexicana, Gray. (*P. Neo-Mexicana*, Thurb. in Bot. Mex. Bound.

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* Phacelia, Juss.—"Calyx deeply 5-parted; the divisions usually narrow and similar. Corolla from almost rotate to narrow-funnelform, deciduous, commonly with appendages upon the inside of the tube in the form of 10 vertical plates or lamellæ approximate in pairs between the bases of the filaments, or else adnate more or less to their base, one on each side. Stamens equally inserted low down or at the base of the corolla. Ovules and seeds from 4 (a pair to each placenta) to very numerous.—Herbs, mostly branched from the base; with simple or compound alternate leaves, or the lower opposite, and more or less scorpoid spicate or racemose cymose inflorescence. Corolla blue, violet, purple or white, never yellow, except sometimes the tube or throat."—Fl. California, 1, p. 506.

p. 143) is distinguished chiefly by the more distinctly crenulate-denticulate lobes of the corolla, a character in which it varies much.—Neutria, N. Mex., at 7,000 feet altitude (155).

PHACELIA TANACETIFOLIA, Benth.—Valley of the Arkansas, Colorado (82). (By oversight published in catalogue (1874) as sub-alpine.)

PHACELIA SERICEA, Gray.—Nevada.

PHACELIA INTEGRIFOLIA, Torr.—Deer Spring, Arizona, at 6,300 feet; hairy form, but hardly, I think, *P. Palmeri*, Torr., in Watson's Bot. King's Survey, p. 251 (181).

HYDROPHYLLUM VIRGINICUM, L.—Apex, Colo. (83).

HYDROPHYLLUM CAPITATUM, Dougl.—Utah.

NAMA HISPIDA, Gray.—Camp Bowie, Ariz., at 5,500 feet altitude (445).

ERIODICTYON* GLUTINOSUM, Benth., var. ANGUSTIFOLIUM, Torr. (*E. angustifolium*, Nutt. Pl. Gambel, 181).—Nearly smooth, with a sticky exudation; linear leaves with revolute margins; inflorescence cymose in a naked panicle; short campanulate corolla 2–3″ long.—Southern Nevada.

BORRAGINACEÆ.

BY PROF. T. C. PORTER.

COLDENIA HISPIDISSIMA, Gray (Watson, Bot. King, p. 247).—Nevada, 1871, 1872, Watson's Rep. (*Eddya*, Torr. Pac. R R. Rep. 2, p. 170, pl. ix); Sunset Crossing, Ariz., 1873, Loew (160 *a*).

COLDENIA PALMERI, Gray (Watson, *l. c.* p. 248).—Nevada, 1871, 1872, Watson's Rep.

HELIOTROPIUM CURASSAVICUM, Linn. (Gray's Man. p. 366; Watson, Bot. King, p. 248).—Nevada, 1871, 1872, Watson's Rep.

HELIOTROPIUM CONVOLVULACEUM, Gray (Bot. Cal. 1, p. 521; *Euploca*, Nutt.).—Annual, with branches a span to a foot long spreading from the

* ERIODICTYON, Benth.—Calyx deeply 5-parted, the lobes or sepals not broader upward. Corolla funnel-form or approaching campanulate or salver-form. Stamens more or less included. Styles 2, distinct to the base; their tips or stigmas clavate-capitate. Capsule crustaceous, small, globose-ovate and pointed, 2-celled, with dilated placentæ, 4-valved, *i. e.*, at first loculicidal in the manner of the tribe, then septicidal, thus splitting into four hard and thick half-valves, closed by a portion of the partition on one side and partly open on the other. Ovules rather numerous, but seeds few.—Low shrubs; leaves alternate, of rigid coriaceous texture, their margins beset with rigid teeth, the base tapering into more or less of a petiole. Flowers in scorpioid cymes collected in a terminal panicle; corolla violet or purple, varying to white. Filaments variably adnate to the tube of the corolla.—GRAY, Fl. Cal. 1, p. 518.

base, hoary or strigose-hispid; leaves oblong-lanceolate or ovate, petioled; flowers scattered, short-pedicelled, sweet-scented; corolla white, with a rotate limb, plaited but scarcely lobed, and a hairy tube somewhat enlarged above, and the orifice narrowed; anthers with slightly cohering tips; style long; truncate cone of the stigma bearded with stiff bristles; fruit of two globose, solid lobes, each lobe or carpel splitting into two hemispherical one-seeded nutlets.—Deserts of New Mexico, 1873, Loew

Echinospermum Redowskii, Lehm. (Gray's Man. p. 365; Watson, Bot. King, p. 246).—Nevada, 1871, 1872, Watson's Rep.; Twin Lakes, Colorado, 1873, Wolf (694, 705); Pescado, N. Mex., at 7,000 feet elevation, July, 1874, Rothrock (154).

Echinospermum floribundum, Lehm. (E. *deflexum*, Lehm., var *floribundum*, Watson, Bot. King, p. 246).—Twin Lakes, Colorado, 1873, Wolf (697).

Eritrichium nanum, Schrad., var. aretioides, Herder (Gray, Proc. Am. Acad. 10, p. 56; *E. aretioides*, DC.; *E. villosum*, DC., var. *aretioides*, Gray; Watson, Bot. King, p. 241).—Mountains of Colorado, at 13,000 feet elevation; June, 1873, Wolf (708).

Eritrichium Californicum, DC. (Watson, Bot. King, p. 242).—Central Colorado, 1873, Wolf (689, 691, 692).

Eritrichium angustifolium, Torr. (Watson, *l. c.* p. 241).—San Luis Valley, Colorado, September, 1873, Wolf (704).

Eritrichium crassisepalum, Torr. & Gray (P. R. R. Survey, 2, p. 171).—Annual, very hispid with spreading hairs; stem much branched from the base, branches ascending, 3 to 5 inches high; leaves obovate-lanceolate, rather obtuse; racemes bracteate below; fructiferous calyx ventricose at base, closed and contracted above the middle, the segments thickened and indurated on the back, finely pilose on the margins, with large, strong, hispid hairs on the back; nutlets heteromorphous, ovate, convex on the back, three of them muricate-granulate, the fourth larger and nearly or quite glabrous.—Colorado, 1873, Wolf.

Eritrichium Jamesii, Torr. (Marcy's Rep. p. 294).—Hirsute, much branched from a suffruticose base; branches 6 to 10 inches high; leaves linear-lanceolate, tapering to the base, 1 to 2 inches long; spikes terminal,

numerous; flowers on very short pedicels; calyx campanulate, at first scarcely longer than the tube of the corolla, but in fruit elongated and closed, segments ovate; corolla ochroleucous, tube shorter than the calyx-teeth, spreading limb 2 to 3 lines wide, lobes very obtuse; nutlets 4, similar, depressed, conniving at the top, but separated at the sides, very convex and smooth on the back, shining, edges very acute, ventral suture adhering to the style above the middle.—Denver, Colorado, June, 1873, Wolf (696); Western New Mexico, at 6,500 feet elevation, July, 1874, Rothrock (130).

ERITRICHIUM GLOMERATUM, DC. (Watson, Bot. King, p. 242).—Twin Lakes, Colorado, July, 1873, Wolf (700, 702).

MERTENSIA OBLONGIFOLIA, DC. (Watson, Bot. King, p 238).—Apex, Colo., 1873, Wolf (709 *a*).

MERTENSIA SIBIRICA, Don.—Utah, 1871, 1872, Watson's Rep.; Colorado, 1873, Wolf (709 *b*).

MERTENSIA PANICULATA, Don.—Arizona, 1873, Loew (162 *a*); Colorado, 1873, Wolf (709).

MERTENSIA LANCEOLATA, DC. Prod. 10, p. 88 (*Pulmonaria lanceolata*, Pursh, and *P. marginata*, Nutt., Gray, Proc. Am. Acad. 10, p. 53).—Stem erect, glabrous, about one foot high; leaves glaucescent, somewhat fleshy, ciliate, lower oblong-spatulate or oblong-ovate, upper ovate, acute, partly clasping; racemes 4- to 8-flowered, sub-fasciculate, scarcely longer than the leaves; corolla with a funnel-form tube twice longer than the calyx; stamens inserted in the throat; anthers sagittate—Willow Spring, Arizona, at 7,400 feet elevation, July, 1874, Rothrock (246).

LITHOSPERMUM PILOSUM, Nutt. (Watson, Bot. King, p. 238).—Utah, 1871, 1872, Watson's Rep.

LITHOSPERMUM MULTIFLORUM, Torr. (Watson, Bot. King, p. 238, under *L. pilosum*, Gray, Proc. Am. Acad. 10, p. 51).—New Mexico, 1873, Loew (161 *a*); Grant Post Office, Colo., July, 1873, Wolf (698); Willow Spring, Arizona, at 7,195 feet elevation, July, 1874, Rothrock (201).

LITHOSPERMUM CANESCENS, Lehm., var. (Gray's Man. p. 363).—Tonto Basin, Arizona, 1873, Loew (162 *a*); Willow Spring, at 8,000 feet elevation, and Sanoita Valley, Southern Arizona, at 4,000 feet elevation, 1874, Rothrock (202, 633).

ONOSMODIUM THURBERI, Gray, Syn. Fl. p. 205. (*Macromeria viridiflora*, Torr. in Mex. Bound. Surv. p. 139, not of A. DC.)—Stem erect, 2 to 3 feet high hispid with spreading hairs; leaves ovate-lanceolate, 2 to 3½ inches long, 6 to 12 lines wide, covered on both sides with a close appressed pubescence, hispid also on the upper side with stiffish, erect hairs arising from a callous base, and on the under side with softer, somewhat villous hairs, especially on the rib-like nerves, sessile and partly clasping; flowers one inch and a half long, tubular-funnelform, greenish and very hairy on the outside, yellow within; calyx about one-fourth the length of the corolla, the divisions much elongated in fruit; stamens at first included, but at length exserted; nutlets ovate, more than a line long, smooth and shining. Willow Spring, Arizona, 1874, Rothrock (227).

CONVOLVULACEÆ.

IPOMŒA HEDERACEA, Jacq. Gray, Syn. Fl. part 1, p. 210. (*Ipomœa Nil*, Roth.)—Southern Arizona (505, 524), where it forms dense masses, often an acre in area.

IPOMŒA MEXICANA, Gray, Syn. Fl. part 1, p. 210. (*Ipomœa Nil*, var. *diversifolia*, Choisy in DC. Prod. ix, p. 343. *Pharbitis diversifolia*, Lindl. Bot. Reg. t. 1988)—Probably only a form, distinguished (so far as my specimen shows) by its shorter, broader calyx-lobes, and also, on authority of Choisy, by the lower leaves being cordate-acuminate, and the others 3-lobed.—Arizona (150 *a*, Loew).

IPOMŒA MURICATA, Cav.—Nearly smooth, with a tuberose root; stem prostrate; leaves deeply palmately-parted, the 6–8 divisions narrowly linear, but slightly dilated upward, 4–9″ long, petiole 1″ long; corolla 12–14″ long, purple, tube slender; sepals ovate or lance-ovate, obtuse or slightly mucronate, evidently muriculate on the back. The slender stems hardly a foot long; flowers infundibuliform and somewhat disproportionately large.—Sanoita Valley, Arizona (623).

IPOMŒA COSTELLATA, Torr.—Herbaceous, smoothish or somewhat hairy, branching, slender; leaves palmately-parted, 5–7 divisions, which are linear to lanceolate-spatulate, and sometimes sparingly ciliate, 4–7″ long; petioles 2–5″ long; pedicels slightly thickened; flowers purple or whitish, funnel-

shaped; lobes short; sepals oblong, margins slightly scarious, distinctly 2–3-keeled; style entire, the 2-lobed stigma very slightly roughened; seeds in my specimens smooth or nearly so. (590 a hairy form.)—Southern Arizona (631, 679, 623 *a*); common.

IPOMŒA LEPTOPHYLLA, Torr.—Perennial; stems smooth, often erect and bushy, usually prostrate; leaves thickish, sessile, entire, acute, lance-linear, 3′ long, veiny; peduncles 1–3-flowered; sepals ovate, obtuse, somewhat mucronate. Corolla with a spreading border, 1½′ across; tube 1½′ long; filaments hairy below, inserted near the base of the corolla; style equalling the stamens, lobes of the stigma capitate.—Loew; probably from along the Arkansas.

IPOMŒA COCCINEA, L. (*Quamoclit coccinea*, Mœnch).—Southern Arizona (559).

CONVOLVULUS SEPIUM, L., var. REPENS, Gray (*Calystegia sepium*, R. Br., var. *pubescens*, Gray).—Zuñi, N. Mex, 6,500 feet altitude (162).

CONVOLVULUS INCANUS, Vahl.—Twining, silky-hairy; stems terete; leaves linear-lanceolate, 9–18″ long, somewhat cordate, and distinctly auricled at base; auricles diverging and recurved, entire or more or less deeply 2–3-lobed; petioles 2–6″ long; peduncles 1–2½′ long, bearing a pair of small bracts above the middle; sepals villous, ovate, rather obtuse, half as long as the broadly infundibuliform hairy corolla; lobes of corolla distinctly hairy-tipped.—Arizona (Loew, 150 *a*); (482) at 5,300 feet altitude.

CONVOLVULUS LONGIPES, Watson (American Naturalist, 7, 302).—"Glabrous, glaucous, twining; leaves linear, 1 inch long or less, entire or auricled at base, petioled; peduncles elongated, 2–6 inches long, mostly strict, 2–3-bracted, usually 1-flowered; bracts linear; calyx-lobes rounded, obtuse or emarginate; corolla funnel-form, 1¼ inches long, yellowish.—Southern Nevada."—PLATE XX. Fig. 1. Natural size. 2 Pistil. 3. Cross-section of ovary. 4. Stamen. Figs. 2, 3, and 4 enlarged.

EVOLVULUS* SERICEUS, Swartz.—Spreading, procumbent, branches 4–8′ long; leaves sessile, lanceolate to oblong, acute or obtuse, smooth or nearly so above, densely silky-hairy below; pedicels axillary, 1–3″ long; sepals

*EVOLVULUS, L.—A genus of about 70 species, natives mostly of Tropical America; distinguished from *Convolvulus* in having two styles, and each of these being divided into two linear-filiform stigmas; and also by the ovary being sometimes 1-celled from the disappearance of the partition.

lanceolate, hairy, acute, as long as or exceeding the pedicels; corolla whitish, 6″ long. Choisy, in DC. Prod. vol. ix, p. 443, speaks of the peduncles as being 1–3-flowered. In all my specimens, the flowers are solitary.—Ash Creek, Arizona (152 *a*, Loew, and 307).

Evolvulus Arizonicus, Gray.—Procumbent or ascending, 6–12′ long, silky-hairy; leaves linear-lanceolate to lanceolate, acute, 4–10″ long; peduncles capillary, 6–18″ long, bracteate at the forks and bearing 1–3 flowers (usually 3); flowers blue, 6–8″ in diameter, salver-shaped; sepals acute; anthers distinctly auriculate at base; pedicels reflexed after fall of the flower; ovary 1-celled.—Camp Grant, Ariz. (376 and 151 *a*, Loew, Arizona).

Cressa Cretica, L., var. Truxillensis, Chois.—Arizona.

CUSCUTEÆ.

By Dr. George Engelmann.

Cuscuta (Clistogrammica) salina, Engelm.—Stems slender, low; flowers (1½–2½ lines long) delicate white, pedicelled in loose cymes; calyx-lobes ovate-lanceolate acute, as long as the similar but mostly broader and overlapping denticulate lobes, and as the shallow-campanulate tube of the corolla; filaments about as long as the oval anthers; fringed scales mostly shorter than the tube, sometimes incomplete; styles equalling or shorter than the somewhat pointed ovary; capsule surrounded (not covered) by the withering corolla, mostly 1-seeded.

Saline or brackish marshes in the Gila Valley on *Suæda*, Rothrock (333), 1874; also on the California coast, near Santa Barbara, on *Frankenia* and *Salsola*, Rothrock (101), 1875. Similar to *C. Californica*, from which it is at once distinguished by its larger flowers and the presence of the infra-stamineal scales.

Cuscuta (Clistogrammica) arvensis, Beyrich.—Ash Creek, on *Solidago*, Rothrock (311), 1874, and Camp Lowell, on *Datura meteloides*, Rothrock (708), 1874. These specimens, especially the latter, growing on a very juicy nurse-plant, have coarser stems than the Southeastern form and larger flowers and fruit; the calyx is not angular, its lobes rounded; those of the corolla very acute.

Cuscuta (Clistogrammica) decora, Choisy, Engelm.—In the Gila Valley on a low, spiny, rhamnaceous shrub. Rothrock (326), 1874. A large form, the same as the one from California.

SOLANACEÆ.

Solanum nigrum, L., var. Douglasii, Gray (*S. Douglasii*, Dunal, in DC. Prod. xiii, p. 48).—Glabrous or even tomentose-puberulent leaves (sometimes in California specimens thickish, on short petioles) deeply and irregularly crenate; flowers 6″ in diameter.—Camp Grant, Ariz. (388).

Var. Dillenii, Gray (or near it, *fide* Professor Gray). (*S. Dillenii*, Dunal, DC. Prod. xiii, p. 47.)—Slightly puberulent; leaves entire or nearly so, acute, attenuate into a petiole, 2–3½′ long and one-third as wide; flowers umbellate, erect; short filaments more or less hairy; fruit reflexed; style hairy, especially at base, and geniculate toward the capitate stigma; flowers 4″ in diameter.—Camp Lowell, Ariz. (707). Very slender and straggling herb. Probably the same as *S. nodiflorum* of the Mex. Bound. Survey.

Solanum Jamesii, Torr. (in Ann. Lyc. N. Y. 2, p. 227, and Gray in Sill. Jour. n. ser. 22, p. 284).—Glabrous, or with a few longish hairs; leaves oval; leaflets 7–11, decreasing and becoming distant toward the base, slightly decurrent; calyx-lobes triangular-ovate, half as-long as the corolla; filaments smooth; style smooth, moderately thickened upwardly; stigma slightly two-lobed and capitate; inner valve of the anthers so conspicuously shorter than the outer as to make the anthers (seen from the extremity) almost bilabiate; racemes extra-axillary, 4–5-flowered.—Loew, Arizona (158 *a*).

Solanum triflorum, Nutt.—Herbaceous or a little woody at base, unarmed, much branched, somewhat chaffy-hairy; leaves petioled, lanceolate to oval, deeply sinuate, or runcinate-lobed; calyx-lobes oblong, obtuse, somewhat hairy; flower 4″ in diameter, whitish; fruit 6″ in diameter, smooth, dark, reflexed.—South Park and Colorado Springs, Colorado (88).

Solanum rostratum, Dunal.—A well-marked, prickly species, with a slightly irregular, yellow corolla, one anther larger than the rest, and prolonged into a somewhat curved beak, the prickly calyx inclosing the fruit.—Arizona, Loew.

Solanum elæagnifolium, Cav.—Stems and midribs usually with short

and rather weak prickles; entire plant whitish, with a dense stellate pubescence; leaves lanceolate, entire, or wavy-margined (sometimes slightly lobed); flower blue, 9″ in diameter, the linear anthers opening only at the tip; ovary tomentose; mature berry black, 6″ in diameter.—New Mexico and Arizona (83, 342).

Chamæsaracha* sordida, Gray (*Withania? sordida*, Dunal, in DC. Prod. xiii, p. 456; also in Bot. Mex. Bound. p. 155).—Branching, somewhat glandular-pubescent; leaves oblanceolate, entire, attenuate into a petiole; calyx glandular-hairy, with forked hairs; corolla sulphur-yellow, 6″ in diameter; stamens sub-exserted; style clavate; stigma sub-capitate.—Camp Bowie, Arizona, at 5,300 feet (471).

Chamæsaracha Coronopus, Gray (*Withania? Coronopus*, Torr. Bot. Mex. Bound. p. 155).—Smoothish or slightly glandular-hairy, branching; leaves linear-lanceolate, attenuate into a petiole, irregularly deeply sinuate-toothed, thickish; calyx with forked hairs. Corolla light yellow; stamens sub-included; style clavate; stigma sub-capitate.—McArthy's Ranch, New Mexico (111). Notwithstanding the difference in leaves usually manifested by these two species, there is a decided tendency for them to vary toward each other; this along with the similar pubescence, the close resemblance of the flowers, and the same prominently ridged and roughened campylotropous seeds, make me feel almost sure they will have to come together.

Physalis lobata, Torr.—Low, spreading; root perennial; leaves oval or spatulate, tapering into a margined petiole. Corolla violet-purple; fruiting calyx 6″ in diameter, winged, inflated; entire plant glabrous, except the young calyx and pedicels, which are "mealy"; seeds thickish, somewhat tuberculate roughened.—Deer Spring, Arizona, 6,000 feet altitude (189).

Physalis viscosa, L.—Utah.

"Physalis ——— ?—Near *P. pubescens*, but leaves small and mostly

*"Chamæsaracha, Gray.—Calyx 5-lobed, enlarging after flowering, but remaining rather herbaceous, not reticulated, incompletely investing the rather dry-globose berry. Corolla rotate, 5-angulate. Anthers short, on slender (not at all connivent) filaments, the cells opening lengthwise throughout.—Low Texano-Californian herbs; with the corolla of *Saracha* and a calyx between that of *Solanum* and *Physalis*, with rather narrow leaves tapering into margined petioles, and in their axils filiform solitary or sometimes geminate pedicels, which are mostly refracted, or recurved in fruit. Corolla white, yellowish, or tinged with violet."—Gray, Fl. Cal. 1, p. 540.

suborbicular; stems flexuose.—Arizona."—(Watson in Wheeler's Preliminary Report, 1874, p. 14.)

LYCIUM PALLIDUM, Miers.—*Fruit eaten*, but insipid. El Puerco, N. Mex., at 5,000 feet altitude, on dry gravel soils or mesas (90).

LYCIUM ANDERSONII, Gray, var. WRIGHTII, Gray.—The variety is only a more leafy, fewer- and smaller-flowered, spiny form of the species.—Camp Bowie, Ariz. (448). Nevada.

DATURA METELOIDES, DC.—Perennial, 2–4° high, whitish from a very close soft pubescence; calyx (flowering) 2–4′ long, 6–8″ in diameter; corolla pale blue, regularly funnel-shaped, 6–9′ long and about 5′ in diameter across the mouth, with 5 slender, delicate lobes 6–12″ long. Capsule prickly, nodding on a short peduncle, when ripe opening irregularly; seeds surrounded with a cord-like margin. This is the common *Datura Wrightii* of the gardens.—Common in the southern and southwestern part of the United States, and extending into Mexico—Camp Grant, Ariz. (381).

NICOTIANA TRIGONOPHYLLA, Dunal.—Usually rather slender, 2° high, from a hardened or woody base. Viscidly pubescent; leaves lanceolate-oblong, obtuse or acute, tapering to a petiole, or dilated auriculate at base; flowers pedicellate, somewhat unilateral by a curve in some of the pedicels, greenish or yellowish-white, about 1′ long; orifice often a little constricted; lobes short, spreading slightly; calyx-lobes variable, from narrowly to broadly triangular.—Camp Crittenden, Southern Arizona, at 5,000 feet altitude. No. 354, from Cottonwood, Arizona, appears to be a form of this species, but has longer, narrower calyx-lobes, and much more spreading and acute lobes to the corolla. It is withal also a much more branching plant.

NICOTIANA ATTENUATA, Torr.—Nevada and Utah.

SCROPHULARINEÆ.

BY PROF. T. C. PORTER.

VERBASCUM THAPSUS, Linn. (Gray's Man. p. 325).—Utah, 1871, 1872, Watson's Report.

ANTIRRHINUM MAURANDIOIDES, Gray (Proc. Am. Acad. 7, p. 376.

Maurandia antirrhiniflora, Willd. DC. Prod. 10, p. 296).—Glabrous, diffusely branching; branches slender, climbing high by the flexuose and prehensile petioles and peduncles; leaves numerous, triangular-hastate or sagittate, rarely cordate-hastate, angulate; pedicels axillary; segments of the calyx lanceolate, 5 to 6 lines long, very smooth; corolla scarce an inch long, smooth, its prominent palate pilose and almost closing the throat.—Arizona, 1871, 1872, Watson's Report; 1874, Rothrock (93 *a*); Cottonwood, Arizona, at 4,500 feet elevation, July, 1874, Rothrock (353); Camp Crittenden, September, 1874, Rothrock (680).

SCROPHULARIA NODOSA, Linn. (Gray's Man. p. 327).—Mount Graham, Arizona, at 9,250 feet elevation, August, 1874, Rothrock (410).

COLLINSIA PARVIFLORA, Dougl. (Gray's Man. p. 327).—Nevada, 1871, 1872, Watson's Report; Apex, Colo, 1873, Wolf (328).

PENTSTEMON BARBATUS, Nutt., var. TORREYI, Gray (Watson's, Bot. King, p. 452).—Arizona, 1873, Loew (304).

PENTSTEMON BARBATUS, Nutt., var. TRICHANDER, Gray (Proc. Am. Acad. 11, p. 94).—Anthers sparingly bearded with long wool.—Zuñi Mountains, New Mexico, at 7,000 feet elevation, July, 1874, Rothrock (151).

PENTSTEMON GLABER, Pursh (Watson, *l. c.* p. 217).—Nevada and Utah, 1871, 1872, Watson's Report; Plains of Colorado, 1873, Wolf (299); Neutria, N. Mex., at 7,100 feet elevation (147).

PENTSTEMON FREMONTI, T. & G. (Watson, *l. c.* p. 218).—Nevada and Utah, 1871, 1872, Watson's Report.

PENTSTEMON CÆRULEUS, Nutt. (Watson, *l. c.* p. 218).—Denver, Colo., 1873, Wolf (291, 296).

PENTSTEMON ACUMINATUS, Dougl. (Watson, *l. c.* p. 218).—South Park, Colorado, 1873, Wolf (302).

PENTSTEMON SECUNDIFLORUS, Benth. (DC. Prod. 10, p. 325).—Glabrous, pale and somewhat glaucous, 1–2½ feet high; radical leaves petioled, elliptic-spatulate or narrowly lanceolate, obtuse or acute, upper ones lanceolate or linear-lanceolate, sessile, middle ones 3 to 4 inches long, erect; thyrsus elongated, narrow, 6 to 9 inches long, interrupted; cymes secund, few- to many-flowered; segments of the calyx oval-oblong, acute or acutish, with membranous margins; tube of the corolla more or less abruptly

enlarged below the middle; anthers glabrous or very minutely puberulent; sterile filament dilated at the apex, bearded or smooth.—Arizona?, 1873, Loew (159 *a*); South Park, Colorado, August, 1873, Wolf (300); Mount Graham, Arizona, at 9,250 feet elevation, August, 1874, Rothrock (400).

PENTSTEMON EATONI, Gray, Proc. Am. Acad. 8, p. 395 (*P. centranthifolius*, Watson, Bot. King, p. 219, not Benth).—Utah; Belmont, Nev., 1871, 1872, Watson's Report.

PENTSTEMON WRIGHTII, Hook. (Watson, *l. c.* p. 453).—Utah, 1871, 1872, Watson's Report.

PENTSTEMON VIRGATUS, Gray (Watson, *l. c.* p 453).—Neutria, N. Mex., at 7,100 feet elevation, July, 1874, Rothrock (150.)—Arizona, Rothrock (264).

PENTSTEMON AMBIGUUS, Torr. (Ann. N. Y. Lyc. 2, p. 228; Marcy's Rep. p. 279, t. 16).—Glabrous, 1 to 2 feet high, paniculately branching from a woody base; lower leaves linear, attenuated below, upper ones subulate-filiform or acerose-subulate; racemes loosely flowered; peduncles opposite; corolla scarcely bilabiate, 5 to 8 lines long; tube 6 lines long, little dilated above, often incurved, the spreading limb 6 lines in diameter; sterile filaments glabrous.—Western New Mexico and Eastern Arizona, 1873, Loew (688, 860); Algodones, N. Mex, at 6,000 feet elevation, June, 1874, Rothrock (79); Camp Grant, August, 1874, Rothrock (440).

PENTSTEMON LINARIOIDES, Gray (Proc. Am. Acad. 6, p 66).—Minutely pruinose-puberulent; stems 6 to 18 inches high, many, from a woody base, very leafy; leaves 1 inch long or less, spatulate-linear to subulate; peduncles and pedicels short, alternate; panicle narrow, sub-secund; corolla purplish, short-bilabiate, over $\frac{1}{2}$ an inch long, much dilated above; palate and sterile filament bearded—Arizona, 1871, 1872, Watson's Report; "Tanks," south of Camp Apache, July, 1874, Rothrock (265).

PENTSTEMON ALBIDUS, Nutt (Gray, *l. c* p. 67)—Stem puberulent, 6 to 9 inches high; lower leaves petioled, oblong, obtuse, sub-entire, upper ones serrate, lanceolate, glabrous or puberulent; thyrsus oblong, subverticillately interrupted; cymes subsessile, few-flowered; sepals lanceolate, very viscid-pubescent; tube of the corolla widened above, three-fourths of

an inch long, purplish-white, the limb beardless; beard of the sterile filament rather short, somewhat interrupted.—Colorado, 1873, Wolf (292).

PENTSTEMON CRISTATUS, Nutt. (Watson, Bot King, p. 219).—Agua Azul, N. Mex., July, 1874, Rothrock (129).

PENISTEMON JAMESII, Benth. (Gray, *l. c.* p. 67).—Puberulent, 4 to 12 inches high; leaves linear-lanceolate, often denticulate, rigid; cymelets 3- to 4-flowered in a spicate panicle; sepals viscid-puberulent; corolla 1 inch or more long, pale purple, abruptly campanulate above, the lip and sterile filaments less bearded than in *P. cristatus*.—Santa Fé, N. Mex., June 1874, Rothrock (2).

PENTSTEMON HUMILIS, Nutt. (Watson, *l. c.* p. 220).—South Park, Colorado, 1873, Wolf.

PENTSTEMON GLAUCUS, Grah., var STENOSEPALUS, Gray (Watson, *l. c.* p. 221).—Utah, 1871, 1872, Watson's Rep.; mountains of Colorado, 1873, Wolf (297, 298, 301).

PENTSTEMON HALLII, Gray (Proc. Am. Acad. 6, p. 70).—Stems 3 to 5 inches high, numerous, glabrous except the very minutely glandular inflorescence; leaves entire, pale, linear-spatulate or linear-attenuate at base; raceme simple, 4–10-flowered with short pedicels; sepals ovate or oblong with scarious and often erose margins; corolla deep blue, about 1 inch long, ventricose-campanulate above the short base, the lips short; the sterile filament short-bearded.—South Park, Colorado, July, 1873, Wolf (303). Var. ARIZONICUS, Gray, Mount Graham, Arizona, at 9,250 feet elevation, August, 1874, Rothrock (426).

PENTSTEMON CONFERTUS, Dougl., var CÆRULEO-PURPUREUS, Gray (Watson, *l. c.* p. 221).—Nevada and Utah, 1871, 1872, Watson's Rep; South Park, Colorado, 1873, Wolf (293, 294).

PENTSTEMON DEUSTUS, Dougl. (Watson, *l. c.* p. 221).—Nevada, 1871, 1872, Watson's Rep.

PENTSTEMON LÆTUS, Gray (Watson, *l. c.* p. 455).—Mineral Hill, Nevada, 1871, 1872, Watson's Rep.

CHIONOPHILA JAMESII, Benth.—Low, glabrous, from a thick rootstock; stem scapiform, 1 to 4 inches high, with a pair of leaves above the middle, terminated by a crowded spike of flowers; radical leaves tapering into the

expanded, membranaceous, hyaline bases, spatulate or oblong-linear, obtuse, very entire, thickish; flowers 2 to 4, crowded; bracts opposite, ovate, connate at base, obtuse or acute, unequal; flowers yellowish, on very short pedicels; calyx 4 to 5 lines long, campanulate; teeth broad, obtuse; corolla a little longer; lower lip densely tomentose within.—High alpine. Mountains of Colorado, 1873, Wolf (332).

Mimulus Bigelovii, Gray (*Eunanus Bigelovii*, Gray, Watson's Bot. King, p. 226).—Nevada, 1871, 1872, Watson's Report.

Mimulus nanus, Hook. & Arn. (*Eunanus Fremonti*, Watson, Bot. King, p. 226, not of Benth.).—Nevada, 1871, 1872; Watson's Report.

Mimulus cardinalis, Dougl. (Gray, Bot. Calif 1, p. 566).—Perennial, 1 to 2 feet or more high, villous with viscid hairs; leaves ovate, the upper often connate, erosely dentate; calyx oblong, prismatic, the short teeth nearly equal; corolla scarlet, 1½ to 2 inches long, its tube but little longer than the calyx; limb oblique, with the upper lobe erect and the two lateral ones and the lower reflexed; stamens projecting, villous or pubescent.—Mount Graham, Arizona, at 9,250 feet elevation, August, 1874, Rothrock (401). Var.—Low, with leaves attenuate to the base, Arizona, 1871, 1872, Watson's Report.

Mimulus luteus, Linn. (Watson, *l. c.* p. 223).—Nevada, Arizona, and Utah, 1871, 1872, Watson's Report; Twin Lakes, Colorado, at 10,000 feet elevation, 1873, Wolf (313); Santa Fé, N. Mex., 1874, Rothrock (28), at 7,044 feet elevation; Cave Spring, Arizona, July, 1874, Rothrock (193); Eastern Arizona, 1873, Loew (310).

Mimulus luteus, Linn., var. alpinus, Gray (Watson, *l. c.* p. 224).—Twin Lakes, Colorado, 1873, Wolf (313 *bis*).

Mimulus Jamesii, Torr. (Gray's Man. p. 328).—Denver, Colorado, June, 1873, Wolf (312).

Mimulus floribundus, Dougl. (Watson, *l. c.* p. 224).—San Luis Valley, Colorado, September, 1873, Wolf (311).

Mimulus pilosus, Watson (Bot. King, p. 224).—Nevada, Watson's Report.

Herpestis chamædryoides, H. B. K. (DC. Prod. 10, p 393).—Low, decumbent, branching; leaves short-petioled, ovate, cuneate or rarely

rounded at the base, dentate, commonly 6 to 9 lines long; pedicels solitary, about equalling the leaves in length or a little longer, bractless; calyx in fruit 3 to 5 lines long, the posterior segment ovate, the anterior ovate or oblong, the corolla a little longer than the calyx, the upper lip emarginate.—In wet sand, Camp Lowell, Arizona, September, 1873, Rothrock (709).

Conobea intermedia, Gray (Bound. Surv. p. 117).—Annual, erect, spreading, 2 to 6 inches high, viscid-pubescent; leaves subpinnately-parted; flowers very short-peduncled, purple, twice as large as those of *C. multifida;* cells of the anthers subcontiguous; capsule 3 to 4 lines long, ovate-lanceolate, pointed, one-half longer than the somewhat unequal calyx.—Sanoita Valley, Arizona, at 5,000 feet elevation, July, 1874, Rothrock (649).

Gratiola Virginiana, Linn. (Gray's Man. p. 330).—San Luis Valley, Colorado, September, 1873, Wolf (323).

Limosella aquatica, Linn. (Gray's Man. p. 331).—The typical form. Leaves with a spatulate-oblong blade.—Twin Lakes and San Luis Valley, Colorado, 1873, Wolf (972, 973, 986).

Synthyris plantaginea, Benth. (DC. Prod. 10, p. 455).—Woolly-pubescent, becoming smooth; radical leaves oblong, crenate, thick, coriaceous, 3 to 6 inches long, 2 to 3½ broad, abruptly narrowed at base and somewhat decurrent on the petiole; petioles 2 to 3 inches long, somewhat pilose on the veins and ribs; scape 6 to 12 inches high, furnished with numerous oblong, or orbicular, nearly sessile bracts; flowers in a dense spike, 6 inches long in fruit; fruit scarcely exceeding the round-ovate, persistent bracts.—Western New Mexico, at 6,500 feet elevation, 1873, Loew (317); Clear Creek and South Park, Colorado, at 8–10,000 feet elevation, June, 1873, Wolf (316).

Synthyris alpina, Gray (Sillim. Journ. 2d ser. 34, p. 251) —Somewhat woolly, becoming smooth; radical leaves elliptic or oval, sometimes obcordate, closely crenate, 1 to 2 inches long, on slender petioles; scape 2 to 6 inches high, leafy-bracted; spike short, dense, 9 to 12 lines long; sepals lanceolate, villous on the outside toward the edge with long hairs as well as the bracts; corolla 2-parted; lobes narrow, purplish-blue; stigma capitate; stamens exserted.—South Park, Colorado, 1873, Wolf.

VERONICA AMERICANA, Schweinitz.—South Park, Colorado, 1873, Wolf (336); Santa Fé, N. Mex, at 7,044 feet elevation, June, 1874, Rothrock (30).

VERONICA ALPINA, Linn.—Mosquito Pass, Colorado, July, 1873, Wolf (332).

VERONICA SERPYLLIFOLIA, Linn.—Colorado, 1873, Wolf (331, 333).

VERONICA PEREGRINA, Linn.—Twin Lakes, Colorado, July, 1873, Wolf (330).

VERONICA PEREGRINA, Linn., var. DIFFUSA, Rothrock.—Widely and diffusely branched; bracts entirely like the leaves—On alkaline flats, San Luis Valley, Colorado, 1873, Wolf (335).

GERARDIA WRIGHTII, Gray (Bot. Bound. Survey, p. 118).—Stems simple, from a perennial root, virgate, very scabrous, as well as the linear-filiform, sharply mucronate leaves; peduncles as long as the flowers; calyx truncate, with 5 short teeth; corolla yellow, broadly campanulate from a very short tube, pubescent on the outside, very smooth within; filaments short, only villose at the apex; anthers similar, naked, very obtuse, sagittate at base; cells subulate-awned; stigma clavate—Sanoita Valley, Arizona, at 5,500 feet elevation, August, 1874, Rothrock (643). The specimen agrees in every respect with the original description, except that the stem is not simple, but branched. It is probably like our Eastern *G. purpurea*, which has stems of both kinds. The flowers in the dried state have a yellowish and not a purple tinge.

CASTILLEIA AFFINIS, Hook. & Arn. (Watson, Bot. King, p. 228).—Zuñi, N. Mex., at 6,500 feet elevation, July, 1874, Rothrock (161); Camp Bowie, Arizona, at 5,300 feet elevation, August, 1874, Rothrock (475).

CASTILLEIA MINOR, Gray (*C. affinis*, var. *minor*, Gray, Watson, *l. c.* p. 228).—Nevada and Utah, 1871, 1872, Watson's Report.

CASTILLEIA LINARIÆFOLIA, Benth. (Watson, *l. c.* p. 228)—Twin Lakes, Colorado, at 9–10,000 feet elevation, July, 1873, Wolf (288).

CASTILLEIA PARVIFLORA, Bong. (Watson, *l. c.* p. 229).—Nevada, 1871, 1872, Watson's Report; Arizona, 1873, Loew (286).

CASTILLEIA INTEGRA, Gray (Watson, *l. c.* p. 456).—San Francisco Mountains, Arizona, 1871, 1872, Watson's Report; Western New Mexico, at

6,500 feet elevation, July, 1874, Rothrock (128); Colorado, 1873, Wolf (289, 290).

CASTILLEIA PALLIDA, Kunth (Watson, *l. c.* p. 229).—Utah, 1871, 1872, Watson's Report; South Park, Colorado, 1873, Wolf (285); Gray's Peak (287); Sanoita Valley, Arizona, at 6,500 feet elevation, August, 1874, Rothrock (626).

ORTHOCARPUS LUTEUS, Nutt. (Watson, *l. c.* p. 231).—Twin Lakes, Colorado, August, 1873, Wolf (319).

ORTHOCARPUS TOLMIEI, Hook. & Arn. (Watson, *l. c.* p. 230).—Utah, 1871, 1872, Watson's Report.

CORDYLANTHUS WRIGHTII, Gray (Watson, *l. c.* p. 459).—Mesa south of Black River, Arizona, at 5,700 feet elevation, September, 1874, Rothrock (795).

CORDYLANTHUS LAXIFLORUS, Gray (Watson, *l. c.* p. 232).—"Point of Mountain", Arizona, September, 1874, Rothrock (721).

PEDICULARIS GRŒNLANDICA, Retz. (Watson, *l. c.* p. 233).—South Park, Colorado, 1873, Wolf (281).

PEDICULARIS CRENULATA, Benth.—Pubescent; stems erect, simple, 6 to 12 inches high; leaves all linear-oblong, obtuse, doubly crenate, 9 to 15 lines long; spikes short, densely flowered; calyx cleft on the upper side, minutely 2–3-toothed; galea hooded, subincurved, 2-toothed under the apex.—South Park, Colorado, 1873, Wolf (283, 851).

PEDICULARIS SUDETICA, Willd.—Erect, simple, 8 to 12 inches high, glabrous except the spike; lower leaves pinnately-parted, narrowly lanceolate in outline; segments lanceolate, crenate, or subincised-serrate; upper ones pinnatifid; spike short, densely hirsute-woolly; calyx 5-toothed, teeth entire or the lateral denticulate; galea of the reddish-purple corolla arcuate, scarcely hooded, shortly and broadly subrostrate, 2-toothed under the apex. Var. with smoother spikes and no teeth on the tip of the galea.—South Park, Colorado, 1873, Wolf (279); Mogollon Mesa, Arizona, 1873, Loew (280).

PEDICULARIS PROCERA, Gray.—Stem 1½ to 3 feet high, stout, leafy, bearing above a dense-flowered, softly pubescent spike 9 to 18 inches long; leaves glabrous, pinnately-parted; segments lanceolate, laciniate-pinnatifid, lobes serrate or incised, radical ones 1 to 1½ feet long; bracts elongated,

linear from an ovate-lanceolate base, lower ones pectinate-pinnatifid, exceeding the flowers; calyx about equally 5-cleft, lobes lanceolate, entire, about half shorter than the tube; corolla 1 inch or more long, striate, dirty-green; galea hooded at the apex, not beaked, truncate, 2-toothed, scarcely equalling the 3-lobed lip—Mosquito Pass, Colorado, 1873, Wolf (284); Willow Spring, Arizona, July, 1874, Rothrock (212); Mount Graham, August (45 *a*).

PEDICULARIS RACEMOSA, Dougl. (Watson, *l. c.* p. 234).—Twin Lakes, Colorado, 1873, Wolf (320).

PEDICULARIS PARRYI, Gray.—Very smooth, except the ciliated bracts; stem 6 to 12 inches high, more or less bracted; leaves linear-lanceolate, pectinate-pinnatifid, petioled, cauline ones small, segments linear, acute, about 3 lines long, cartilaginous-serrate; bracts small, trifid; flowers numerous, short-pedicelled, in a narrow spike 1 to 2 inches long, dirty-yellow; calyx membranaceous, marked with 5 striæ, at length subinflated; teeth 5, short, lanceolate, very entire, lanuginose within; galea narrow, apex incurved, gradually produced into a longish, emarginate beak, which is sometimes decurved, much surpassing the lower lip; filaments very smooth—South Park, Colorado, July, 1873, Wolf (282).

OROBANCHACEÆ.

APHYLLON FASCICULATUM, Gray.—Colorado. Attached by its rootlets to those of *Artemisia frigida*, Willd.

APHYLLON MULTIFLORUM, Gray (*A. erianthera*, Engelm. Proc. Amer. Acad. vii, p. 372).—Low, stem 1–3′ high; lower flowers pedicellate; flowers purplish, 8″ long; calyx-lobes linear, acute, 6″ long; anthers very woolly.—Utah.

BIGNONIACEÆ.

MARTYNIA PROBOSCIDEA, Glox.—San Francisco Mountains, Arizona.

MARTYNIA, probably VIOLACEA, Engelm.—Too poor to determine.—Rock Creek Cañon, Arizona (313).

CHILOPSIS* SALIGNA, Don (*C. linearis*, DC. Prod. ix, 227, and of Bot.

* CHILOPSIS, Don.—"Calyx membranaceous, ovate in the bud, irregularly bilabiate, often split deeper on one side. Corolla funnelform, ventricose above, with an ample bilabiately 5-lobed spreading limb; the rounded lobes erose and undulate. Stamens 4 and a sterile filament; cells of the anther

Mex. Bound. p. 110).—Small tree, six inches in diameter at the base, 20 feet high, with many slender branches; wood resembling willow; leaves 3–6′ long, 2–4″ wide, slightly falcate, entire, and the older ones somewhat sticky. The white or purple flowers 18″ long in a terminal raceme; capsules linear, 6–8′ long.—Camp Goodwin, Arizona (344), where, from its appearance and habitat, it is known as Desert Willow.

ACANTHACEÆ.

CALOPHANES* DECUMBENS, Gray, Syn. Fl. 1, 325 (*C. oblongifolia*, Torr. Bot. Mex. Bound. p. 123, not Don).—Procumbent or ascending; herbaceous, except at base; leaves and axillary clusters of flowers secund; stem pubescent, upper surfaces of the leaves slightly so, under surfaces almost smooth, margins and midribs (below) a little hispid; corolla light blue?, funnel-shaped, tube 7–8″ long, border 6″ in diameter, lobes ovate, calyx-lobes linear, setaceous, equal in length to the tube of the corolla, but shorter than the lanceolate bracts; seeds four.—Sanoita Valley, Southern Arizona, at 5,500 feet altitude (637)

RUELLIA† TUBEROSA, Linn., var. OCCIDENTALIS, Gray (Syn. Fl. 1, p. 325).—A pubescent herb, 3° high, branched; leaves oval, somewhat firm, slightly hairy, tapering into a margined petiole; margins crenate or somewhat undulate; terminal panicle naked; flowers blue or purple, 1–2′ long; tube 6–8″ long, suddenly expanded into a wide throat; lobes roundish; stamens and style included; calyx-lobes linear, setaceous pubescent; capsule somewhat hairy, lanceolate or club-shaped, 8–16-seeded.—Cienega, Southern Arizona (560). Probably a good species.

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naked and diverging. Capsule long and linear, terete, resembling that of *Catalpa*, 2-celled, with the at length loose narrow partition contrary to the valves. Seeds oblong, thin, with the wing at each end dissected into a woolly or finely bristly tuft. Cotyledons 2-lobed."—Fl. Cal. 1, p. 587.

* CALOPHANES, Don.—Calyx deeply 5-cleft; lobes setaceo-acuminate. Corolla-tube straight, narrowly cylindrical, somewhat dilated above; limb somewhat spreading and slightly 2-labiate, the 5 obovate lobes somewhat unequal. Stamens 4, perfect, slightly didynamous, inserted in pairs and connate below, included; anthers fixed by the back, oblong, the cells nearly parallel, a little mucronate at base. Style slender, curved above, hispid; ovules 2 in either cell. Capsule oblong-linear, contracted at the base into a solid stipe, somewhat thickened above, 2–4-seeded. Seeds orbicular, flat, borne on acute placental processes.—Herbs, with woody bases, erect or procumbent, the leaves entire, opposite or often fascicled at the axils. The blue or pale flowers sub-sessile in the axils, few or many in a cluster, rarely short cymose.—BENTH. & HOOK. I have kept this genus apart from *Ruellia* solely in deference to Bentham and Hooker.

† RUELLIA, Linn.—Like *Calophanes*, except that the cells of the capsule have each more than two seeds, and the anthers are pointless below.

SIPHONOGLOSSA* LONGIFLORA, Gray (Syn. Fl. 1, p. 328).—Low, uniformly pubescent; leaves opposite, on short petioles, rhombic-ovate to lanceolate, thickish, 6–18″ long; petiole 2–4″ long: flowers yellowish-white; tube very slender, 8–12″ long; stamens included; filaments membranaceous, a little longer than the anther; style very slender, much exceeding the flower, evidently 2-lipped; capsule dark brown, oval; seeds with the margin distinctly notched at the point of attachment.—Specimen was a mere fragment. Cienega, Southern Arizona (573).

ANISACANTHUS† PUMILUS, Nees (*Drejera puberula*, Torr. in Bot. Mex. Bound. p. 121; and Watson in 1874 Report, p. 13).—"The pubescent branches distichous; leaves oblong-lanceolate or linear-lanceolate, puberulent, short-petioled; the short leafy spikes axillary and terminal; the deeply 5-cleft calyx glandular-pubescent, the lobes linear-subulate; tube of the corolla narrow, many times longer than the calyx, inferior lip 3-parted, the lobes lanceolate-linear. Corolla 18″ long, purplish-red Capsule smooth, 6–7″ long, the upper half rhombic-ovate and seminiferous, the lower attenuated to a narrow stipe and empty. Shrub 4–8° high."—Arizona. I have not seen the specimen, and have quoted largely from Bot. Mex. Bound. *l c.*

DICLIPTERA‡ RESUPINATA, Juss.—Stem erect, simple or much branched from a woody base; leaves opposite, glabrous to slightly pubescent, lanceolate to oblong, on a slender petiole, which is 3–6″ long; inflorescence in a compound cymose umbel, with the common peduncle as long as or exceed-

* SIPHONOGLOSSA, Erst.—Calyx 4–5-parted, the short segments narrow. Corolla-tube elongated, narrowly cylindrical, slightly or not at all dilated above; limb spreading, 2-lipped, the posterior lip interior, entire or 2-cleft, the other widely spreading, 3-cleft. Stamens 2, affixed near the apex of the tube; anthers 2-celled, with one cell higher than the other; cells somewhat sharp pointed or spurred; staminodia none. Style filiform, the obtuse apex with 2 short lobes; 2 ovules in either cell. Capsule oblong, contracted at the base into a solid stipe. Seeds 4, or by abortion fewer, suborbicular, compressed marginate, tuberculate-rugose; placental processes obtuse.—Sub-shrubby [or herbaceous], low, spreading, pubescent. Leaves ovate, entire. The subsessile flowers solitary in the axils. The linear bracts short.—BENTH. & HOOK.

† ANISACANTHUS, Nees.—Shrub, posterior lobes of the imbricated corolla interior in the bud. Oval capsule elevated on a conspicuous stipe; ovules two in each cell, attached to the placental processes by the edge; seeds flat; stamens two; anther cells two, equal; rudiments none.

‡ DICLIPTERA, Juss.—"Bracts a pair, valvately inclosing 1–3 flower-buds. Corolla tubular, bilabiate; the upper lip interior in the bud, flat or concave, emarginate or entire; the lower spreading, toothed or lobed. Stamens 2: anthers with 2 cells, one higher than the other, both pointless. Capsule short, flattened contrary to the partition, 4-seeded, the base seedless and stalk-like, the strong processes that bear the seeds curving upward and becoming hook-like at dehiscence. Seeds flat —Mostly herbs: with 6-angled stems, broadish and petioled leaves, and either scattered or clustered flowers: mainly tropical, two or three species reaching the United States."—Fl. Cal vol. 1, p. 589.

ing the special peduncle; bracts ovate-cordate, 2–5-flowered (some of them aborting); flowers 8–10″ long, light purple, lower lip 3-toothed, upper lip ovate. Very variable in foliage and inflorescence.—Cienega, Southern Arizona. Besides this form, I have another resembling it in all respects, save that the inflorescence is more simple; two or three peduncles, 1–1½′ long, rising from the axils at a node, and each terminated by a single pair of the usual ovate-cordate bracts. This difference is constant in my specimen (571), and might entitle it to a specific rank were it not for the variability in just this respect in *D. resupinata.* Also from Cienega, Arizona.

Tetramerium* hispidum, Nees (*T. nervosum*, Nees, "var. *hispidum foliis ovato-oblongis obtusiusculis vel acutis* (*non acuminatis*)", Torr. Bot. Mex. Bound. p. 125).—Bracts conspicuously ciliate, oblong; flower yellowish-white (with the anthers visible through a lobe of the lower lip as a brown spot), 5–7″ long.—In the Sanoita Valley, Arizona (686), near (probably) where the specimens described in Bot. Mex. Bound. *l. c.* were obtained.

VERBENACEÆ.

Lippia Wrightii, Gray (Torr. in Bot. Mex. Bound. p. 126). (*Aloysia scorodonoides*, H. B. K. Nov. Gen. et Sp. 2, p. 260, is a different plant.)—Shrub, 2–4 feet high, much branched; leaves oval, 3–8″ long, thickish, deeply crenate, rugose above and white tomentose-pubescent below, abruptly tapering to a short petiole; hairy spikes 1–1½′ long, paniculate; flowers white, 1–2″ long, tubular, with a spreading, subregular border; stamens subequal, short. Calyx with long, spreading, white hairs. The mature fruit readily separates into two nutlets.—Mount Turnbull (170 *a*, Loew), and elsewhere in Arizona.

Lippia nodiflora, Michx.—Herbaceous or somewhat woody; stem creeping, rooting at the joints; peduncles long, slender; entire plant finely pubescent; leaves oblanceolate or cuneate, serrate toward the apex; white

* Tetramerium, Nees.—Herbaceous bracts narrow, more or less connate in pairs, including single flowers with or without rudiments of others. Calyx short, 5-cleft; lobes linear, delicate. Tube of corolla slender, cylindrical; limb 2-lipped, the hinder lip interior, obovate or oblong, erect, entire, concave, the lower lip 3-parted, with the oblong lobes flat, spreading, the middle one outside. Stamens 2, inserted in the throat and sub-equalling the corolla; anthers 2-celled, the equal, pointless, parallel cells separated by a broadish connective; staminodia 0. Disk rather thick. Style filiform, the stigmatose subclavate apex with 2 very short lobes; 2 ovules in either cell. Capsule ovate-oblong, tapering into a solid stipe at base; placenta during dehiscence torn loose from the valves. Seeds 4, or fewer by abortion, plano-compressed, sub-orbicular.—Pubescent herbs, often shrubby at base. Leaves entire. Flowers rather small, pallid.—Benth. & Hook.

flowers in a dense head on a peduncle much longer than the leaves; calyx flattened, "2-cleft, 2-keeled; fruit corky and not readily separating into the 2 nutlets."—New Mexico, Loew.

VERBENA HASTATA, L.—Utah.

VERBENA BRACTEOSA, Michaux.—Utah.

VERBENA AUBLETIA, L.—Arizona; New Mexico, at Santa Fé (12); also in Rocky Cañon, Arizona.

LABIATÆ.

BY PROF. T. C. PORTER.

MENTHA VIRIDIS, Linn.—Camp Bowie, Arizona, at 5,300 feet elevation, August, 1874, Rothrock (491). Introduced?

MENTHA CANADENSIS, Linn.—Utah, 1871, 1872, Watson's Report; Zuñi, N. Mex, at 6,500 feet elevation, July, 1874, Rothrock (168); Sanoita Valley, Arizona, at 4,350 feet elevation, September, 1874, Rothrock (687).—Var. GLABRATA, Benth., Upper Arkansas, Colorado, 1873, Wolf (778).

LYCOPUS SINUATUS, Ell.—Utah, 1871, 1872, Watson's Report. An imperfect specimen of a *Lycopus*, collected in San Luis Valley, Colorado, September, 1873, by Professor Wolf (782), appears to be *L. lucidus*, Turcz., var. *Americanus*, Gray (Proc. Am. Acad. 8, p. 286)

MONARDELLA ODORATISSIMA, Benth. (Watson, Bot. King, p. 235).—Nevada and Utah, 1871, 1872, Watson's Report.

HEDEOMA HYSSOPIFOLIA, Gray (Proc. Am. Acad. 11, p. 96).—Nearly glabrous; stems from a perennial branching caudex, slender, scarcely a foot high; leaves crowded, nerved, the main ones linear-lanceolate, ½ to ¾ of an inch long and a line wide, the parallel veins running toward the apex, the upper gradually reduced until shorter than the calyx, the lowest much shorter and broader, with strong and more diverging nerves beneath; whorls loosely 3- to 5-flowered; calyx narrow-tubular, slightly hairy, the setaceous teeth incurved, the lower ones exceeding the upper; corolla 7 to 8 lines long and twice the length of the calyx; upper lip 2-lobed—Mount Graham, Arizona, at 9,000 feet elevation, August, 1874, Rothrock (418); Arizona, 1873, Loew (780).—PLATE XVII. Natural size. Fig. 1. Flower, enlarged 5 diameters. Fig. 2. Longitudinal section through flower, 5

diameters. Fig. 3. Calyx, 5 diameters. Fig. 4 Corolla opened longitudinally, showing nutlets, style, and the two perfect and two rudimentary stamens, 5 diameters.

HEDEOMA DENTATA, Torr. (Bot. Bound. Survey, p. 130).—Annual; much branched from the base; branches erect, scarcely 1 foot high, slender, pubescent; leaves oblong-lanceolate, about 5 lines in length, acute, tapering into a short petiole, with 3 to 4 acute teeth on each margin, the veins underneath prominent and thicker at the extremity; whorls usually 6-flowered; teeth of the slightly gibbous calyx unequal, from a broad, subulate base, those of the lower nearly twice as long as those of the upper lip; corolla almost twice as long as the calyx, the upper lip emarginate, the lower 3-lobed, the middle lobe notched.—Camp Grant, Ariz., at 4,753 feet elevation, August, 1874, Rothrock (458), and in Sanoita Valley, at 6,300 feet elevation (628).

SALVIA LANCEOLATA, Willd.—Hoary pubescent; stems 3 to 15 inches high, herbaceous, ascending, branched; leaves lanceolate or oblong-linear, 1 to 2 inches long, rather obtuse or acuminate, narrowed at the base into a long, slender petiole, sparsely and obtusely serrulate in the middle; bracts subulate, a little longer than the short pedicels; raceme simple, 2 to 4 inches long; whorls about 2-flowered, all remote; calyx tubular, striate, puberulent, enlarged in fruit, inflated at the base, teeth acute; corolla blue, a little longer than the calyx, 4 lines long; style short-bearded.—Arizona, 1873, Loew (786); Mount Graham, at 9,250 feet elevation (407), Camp Apache, at 5,000 feet elevation (813), and Camp Crittenden, at 5,000 feet elevation (678), 1874, Rothrock.

AUDIBERTIA INCANA, Benth. (Watson, Bot. King, p. 235).—Nevada, 1871, 1872, Watson's Report.

MONARDA FISTULOSA, Linn.—Willow Spring, Arizona, at 7,195 feet elevation, July, 1874, Rothrock (159 *a*, 242).

MONARDA CITRIODORA, Cervantes (*M. aristata*, Nutt.).—Canescent; a foot high, with numerous spreading branches; leaves linear or oblong-lanceolate, narrowed at the base, sharply and remotely serrate; floral ones and outer bracts sessile, somewhat colored, tipped with a long, subulate awn; whorls many-flowered, compact, remote; calyx striate, pubescent,

bearded in the throat; teeth nearly equal, long, subulate, pilose, penicillate at the apex; tube of the corolla scarcely longer than the calyx-teeth.—Fort Wingate, N. Mex., 1873, Loew (781, 789); Arizona, at Camp Grant, elevation 4,753 feet, July (385); Sanoita Valley, August; Mount Graham, at 9,000 feet elevation, September, 1874, Rothrock (729).

LOPHANTHUS URTICÆFOLIUS, Benth. (Watson, Bot King, p. 236).—Utah, 1871, 1872, Watson's Report; Mount Graham, at 9,000 feet elevation, September, 1874, Rothrock (746).

NEPETA CATARIA, Linn.—Utah, 1871, 1872, Watson's Report. Introduced.

DRACOCEPHALUM PARVIFLORUM, Nutt. (Gray's Man. p. 353).—Twin Lakes, Colorado, 1873, Wolf (784).

SALAZARIA MEXICANA, Torr. (Watson, *l. c.* p. 237).—Nevada, 1871, 1872, Watson's Report.

SCUTELLARIA ANTIRRHINOIDES, Benth. (*S. resinosa* of Watson, Bot. King, p. 237, not Torr.).—Nevada, 1871, 1872, Watson's Report

SCUTELLARIA RESINOSA, Torr (DC. Prod. 12, p. 428).—Glandular-pubescent; stems low, erect, much branched; leaves short-petioled, broadly ovate, obtuse, very entire, rounded at base, floral ones similar; flowers axillary, opposite, secund; corolla villous, more than four times longer than the calyx.—Denver, Colo., June, 1873, Wolf (780). Leaves green on both sides, prominently veined beneath, finely pubescent or glabrate, the hairs tipped with minute resinous glands, the lowest shorter and broader, more rounded at base, but never cordate, the upper 5 to 9 lines long, varying from ovate to lance-ovate, more or less attenuate at base; corolla blue, densely villous, erect or ascending, the tube often curved below.

SCUTELLARIA GALERICULATA, Linn. (Gray's Man. p. 357).—San Luis Valley, Colorado, September, 1873, Wolf (779, 781); Willow Spring, Arizona, at 7,195 feet elevation, July, 1874, Rothrock (245).

BRUNELLA VULGARIS, Linn.—Summit Spring, Arizona, at 8,000 feet elevation, July, 1874, and Sanoita Valley, August, 1874, at 5,500 feet elevation, Rothrock (198, 650).

STACHYS COCCINEA, Jacq. (DC. Prod. 12, p. 467).—Herbaceous, erect,

softly pubescent, villous or hispid; leaves petioled, ovate-lanceolate, obtuse or acute, crenate, cordate at base; racemes elongated; whorls 6-flowered, all distant; corolla pubescent, nearly thrice longer than the calyx, the tube much exserted.—Camp Grant, Arizona, at 4,753 feet elevation, and Camp Bowie, at 5,300 feet elevation, August, 1874, Rothrock (386, 461, 483). Stems 1 to 2 feet high; hairs clothing the leaves and stems soft and short, or more rigid, especially on the angles of the stem, or almost wanting; leaves deeply or shortly crenate, larger ones sometimes 2 or even 3 inches long; whorls of flowers few, very distant or numerous in a short or long raceme; calyx sessile or pedicellate, with a tube 2 to 3 lines long, and short or long teeth, which are either subspinescent, erect, or somewhat spreading, or long subulate-acuminate; corolla varying from barely 9 lines to more than an inch in length.

STACHYS ALBENS, Gray (Proc. Am. Acad. 7, p. 387).—Tall, 3 to 5 feet high and rather strict, soft-tomentose throughout, with white or whitish wool, leafy; leaves oblong or ovate and mostly cordate, obtuse, crenate, 2 to 3 inches long, the lower short-petioled, the upper nearly sessile; flowers several or numerous in the capitate clusters, which mostly exceed the floral leaves, and form an interrupted, at length elongated, virgate spike from 3 to 9 inches long; calyx turbinate-campanulate, its teeth triangular and awn-pointed; corolla white, with purple dots on the lower lip, glabrous, except the villous beard on the back of the upper lip.—Arizona, 1871, 1872, Watson's Report.

STACHYS ROTHROCKII, Gray (Proc. Am. Acad. 12, p. 82).—A span high, branching from the base, covered with a coat of villous wool; root apparently perennial; leaves all sessile, lanceolate, more or less obtuse, sub-entire, about 1 inch long, the upper floral ones not surpassing the flowers; whorls usually 3-flowered, in a crowded spike; calyx sessile, subcampanulate, teeth subovate, awnless; corolla 4 to 5 lines long, tube scarcely longer than the calyx; upper lip villous on the outside.—Zuñi Village, N. Mex., at 6,500 feet elevation, July, 1874, Rothrock (177).

STACHYS PALUSTRIS, Linn. (Gray's Man. p. 358).—Trout Creek and San Luis Valley, Colorado, 1873, Wolf (783, 785); Willow Spring, Arizona, at 7,195 feet elevation, July, 1874, Rothrock (240).

LAMIUM AMPLEXICAULE, Linn.—Mosquito Pass, Colorado, July, 1873, Wolf (777). Introduced.

TRICHOSTEMA ARIZONICUM, Gray (Proc. Am. Acad. 8, p. 371).—Puberulent; much branched, from a perennial, woody caudex; branches mostly simple, ½ to 1½ feet high; leaves oval and ovate, short-petioled, floral leaves small; bracts minute; peduncles racemose, about 1 inch long, slender, twice or thrice shorter than the 3- to 5-flowered cyme; calyx campanulate, slightly unequal, but equally 5-cleft; lobes ovate-lanceolate, equalling the tube of the corolla; lobes of the corolla spatulate-oblong, declined; filaments not quite an inch long.—Sanoita Valley, Southern Arizona, at 6,500 feet elevation, August, 1874, Rothrock (621).

TETRACLEA* COULTERI, Gray (Sillim. Journ. 2d s. 16, p. 98).—Herbaceous, from a suffruticose base, puberulent, branches erect; leaves opposite, petioled, ovate, subdentate, floral ones similar but smaller; whorls loose, axillary; cymes peduncled, usually 3-flowered; flowers short-pedicelled, white, becoming yellowish after anthesis.—Cienega, Ariz., August, 1874, Rothrock (558).

TEUCRIUM CANADENSE, Linn.—Arizona, 1873, Loew.

PLANTAGINEÆ.

PLANTAGO PATAGONICA, Jacq., var. GNAPHALIOIDES, Gray.—Denver.

PLANTAGO MAJOR, L.—Cienega, Southern Arizona (555).

NYCTAGINEÆ.

MIRABILIS MULTIFLORA, Gray.—Common throughout Arizona, New Mexico, and open grounds of Southern and Central Colorado.

MIRABILIS LONGIFLORA, L.—Cottonwood, Arizona, at 4,500 feet (359).

OXYBAPHUS NYCTAGINEUS, Sweet, var. LATIFOLIUS, Gray.—Differing from the type in having the involucre and younger branches hairy, the leaves

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*TETRACLEA, Gray (Benth. & Hook. Gen. 2, p. 1220).—Calyx broadly campanulate, 10-nerved, deeply 5-cleft; lobes nearly equal. Tube of the corolla exserted, slender, cylindrical; limb spreading, 5-cleft, lobes oboval-oblong, nearly equal. Stamens 4, didynamous, with the anterior pair longer, incurved-ascending, much exserted; anthers 2-celled, cells distinct, parallel. Disk equal, short. Ovary shortly 4-lobed at the apex; style 2-cleft at the apex; lobes subulate, nearly equal. Nutlets obovoid, hard, reticulate-rugose, attached by a broad, keeled areola, extended beyond the middle, leaving no gynophore when detached. Seeds affixed laterally.

broader, subcordate at base, and quite membranaceous—Mount Graham, Arizona, at 9,250 feet altitude (423).

"OXYBAPHUS NYCTAGINEUS, Sweet, var. OBLONGIFOLIUS, Gray.—With small flowers and leaves. Nevada."—WATSON.

OXYBAPHUS HIRSUTUS, Sweet, var.—Leaves lanceolate-linear; stem glabrous or nearly so.—Willow Spring, Arizona, at 7,195 feet (206).

OXYBAPHUS ANGUSTIFOLIUS, Sweet.—Colorado (810, 811, 814), and Nevada and Arizona.

OXYBAPHUS COCCINEUS, Torr.—Erect, glabrous; leaves 2–4′ long, 1–3″ wide; inflorescence in a loose, terminal panicle; perianth 3-flowered, tinged with purple, pubescent; calyx 6–8″ long, pubescent externally; stamens 5, exserted; fruit with 5 corky wings, somewhat roughened.

ALLIONIA INCARNATA, L.—(324), Ash Creek, Arizona. 156 *a*, collected by Loew in Arizona, and having the marginal teeth on the fruit quite gland-like, and comparing well with Palmer's specimen in 1875 from St. George, Utah, which I find Mr. Watson marks with a doubt. Besides this, I have 107 from Covero, New Mexico, in which the leaves are quite oval, obtuse, and veiny beneath, and the marginal wings of the fruit developed into strong, uncinate, glandular teeth, much larger than the central ones, which they conceal. This may be a distinct species. My specimens are quite variable, some having 4, 5, and even 6 stamens, either included or exserted. The Expedition has it also from Nevada.

ABRONIA FRAGRANS, Nutt.—Colorado (808, 812, 813), and New Mexico (127), where, in the evening, it was the most fragrant of flowers.

ABRONIA TURBINATA, Torr.—Gila Valley, Arizona (340, 765).

ABRONIA VILLOSA, Watson (American Naturalist, vii, p. 302).—"Covered throughout with a more or less dense villous subglandular spreading pubescence; stems weak and slender; leaves small, $\frac{1}{4}$–1 inch long, oblong or ovate, obtuse or acutish, attenuate into the slender petiole; heads 5–10-flowered; involucral scales narrowly lanceolate, long-acuminate, 3–4 lines long; flowers pink, the lobes obcordate, with a deep sinus; fruit with a firm body, strongly reticulate-pitted, the 3–5 broad wings, consisting of a simple lamina, usually truncate above. Nearest to A. UMBELLATA."—(Watson in Wheeler's Preliminary Report, 1874, p. 15.) I have not seen the speci-

men, and have therefore been obliged to quote the description entire.—PLATE XXIII. Fig. 1. Branch, natural size. Fig. 2. Flower, laid open, enlarged about 5 diameters. Fig. 3. Cross-section of fruit.

ABRONIA CYCLOPTERA, Gray.—Southern Colorado (809, 815) and deserts of New Mexico.

BOERHAAVIA* WRIGHTII, Gray (Amer. Jour. Sci. 2, 15, 322).—Arizona. Erect, branching, viscidly glandular-pubescent, especially above; leaves petioled (or sessile above), lanceolate; inflorescence in a loose, branching panicle; bracts purplish, 3 to each flower, fimbriate ciliate on the margin; calyx border spreading, salver-shaped; stamens 2; fruit obovate, 4-angled or ribbed, somewhat wrinkled, roughened between the angles, 1–2″ long.—Cienega, Arizona, at an altitude of 3,500 feet (570). (157 *a*, Loew, Arizona)

BOERHAAVIA ERECTA, L.—Erect, "branching from the base, swollen at the nodes," glabrous or nearly so; leaves petioled lanceolate to oval, dark glandular-dotted and slightly pubescent; panicle disposed in 3–5-flowered clusters; stamens 2. The narrowly obconical fruit evidently truncate, distinctly 5-angled, "flowers small, purple".—Cienega, Arizona (588), along with the preceding.

BOERHAAVIA GRAHAMI, Gray.—Erect (not climbing, but spreading over lower herbs), woody at base, herbaceous above and glabrous and glaucous; leaves 1–1¼′ long, nearly as wide, margin somewhat undulate, cordate at base; petioles 4–6″ long; common peduncles axillary, much exceeding the leaves; special peduncles about six, 2–4″ long, umbellate; scales of involucre 1–2″ long, greenish, pruinose, perigonium black below, greenish and somewhat short pubescent above; pistils and stamens exserted; stigma capitate; fruit terete, glandular at the apex. Dr. Torrey, in Bot. Mex. Bound. p. 172, thinks this may safely be assigned to *B. scandens*, L. So far as Choisy's description of it goes, DC. Prod. vol. 13, pars 2, p. 454, I can see no reason why it should not, and have simply described it under this name, because it has been so identified by my friend Dr. Gray.—Head of the "Cienega", Southern Arizona (590).

BOERHAAVIA SPICATA, Choisy.—Erect, annual, somewhat pubescent;

* BOERHAAVIA, L.—See Appendix to vol. v, King's Report, p. 475.

lower leaves ovate, often slightly cordate at base, upper ones lanceolate undulate on margin; inflorescence paniculate; racemes few-flowered, terminating the branches; stamens 3, exserted; fruit 5-angled or winged, club-shaped; flowering racemes short, but much elongated when in fruit (378 *a*, Arizona, Loew).

PHYTOLACCEÆ.

RIVINA* LÆVIS, Linn.—Herbaceous above, sub-shrubby below, branching from the base; stem striate and with the leaves puberulent; leaves broadly ovate or ovate-cordate, on slender petioles half their length; flowers purplish; calyx-lobes ovate, as long as the four stamens; anthers oblong; filaments thickish; style 1–2″ long, somewhat curved; stigma capitate, oblique, distinctly papillose.—In clefts of rocks, Southern Arizona (582).

POLYGONACEÆ.

By Prof. T. C. Porter.

ERIOGONUM ALATUM, Torr. (Sitgreaves's Rep. p. 168, t. 8).—Perennial; root stout and blackish; stem erect, 1 to 3 feet high, arising from a short, thick caudex, clothed with the remains of leaves, subflexuous, leafy; branches alternate, erect, paniculate; radical leaves spatulate or oblanceolate, 2 to 4 inches long, 3 to 5 lines wide, hirsute; peduncles terminal, in threes; flowers yellowish; involucre solitary, campanulate, 5-cleft; perigonia glabrous, segments equal; achenia 4 lines long, winged nearly to the base; wings broad, thin; seeds ovate, triangular.—Colorado, 1873, Wolf (806); Willow Spring, Arizona, at 7,195 feet elevation, 1874, Rothrock (204).

ERIOGONUM JAMESII, Benth.—Stems 5 to 12 inches high, cæspitose, from a branched, few-leaved, woody caudex; radical leaves spatulate-ovate or narrowly lanceolate, cauline in verticils of 3 to 5, spatulate or oblong,

* RIVINA, Plum.—Flowers hermaphrodite, 3-bracted; calyx 4-parted, the equal lobes subcorolline. Corolla none. Stamens 4–8, sub-hypogynous, the 4 exterior alternate with the laciniæ of the calyx. Filaments filiform-subulate. Anthers ovate-cordate to narrowly oblong. One-celled ovary simple, with a single amphitropous ovule fixed by the base. The longish style sublateral; capitate stigma papillose; sub-globose berry at length dry. Seed vertical, sub-globose or ovoid, the testa crustaceous; albumen central, mealy, surrounded by the ring-like embryo; radicle descending; cotyledons membranaceous, exterior one larger and embracing the inner; sub-shrubby [or, as in my species, rather herbaceous, except at the slightly woody base]. Moquin, in DC. Prod. vol. 13, pars 2, p. 10.

subsessile, white-tomentose beneath; cyme dichotomous, leafy; involucres in the forks or sessile on the branches, many-flowered, loosely silky-villous externally; segments obovate or spatulate; perigonia somewhat petal-like, white or whitish, the 3 interior segments often becoming longer.—Upper Arkansas River, Colorado, 1873, Wolf (25); Camp Bowie, Arizona, August, 1874, Rothrock (473).

ERIOGONUM FLAVUM, Nutt.—Perennial, canescent with a silky-woolly or hoary pubescence; stems scapiform, 3 to 6 inches high, from a thick, many-parted caudex; leaves spatulate or oblong-spatulate, becoming more or less glabrate above, radical ones crowded on the caudex, those of the involucre about equalling the 2 to 8 rays and of the same number; perigonia golden-yellow, 3 lines long, silky-villous on the outside, funnel-form at base, somewhat produced into a stipe; ovary hirsute at the apex.—South Park, Colorado, 1873, Wolf (26).—Var. ELATIUS, Watson, Twin Lakes, Colorado, August, 1873, Wolf (28); Arizona, 1873, Loew (153 *a*).

ERIOGONUM CÆSPITOSUM, Nutt. (Watson, Bot. King, p. 298).—Utah, and Halleck Station, Nevada, 1871, 1872, Watson's Report.

ERIOGONUM STELLATUM, Benth. (*E. polyanthum*, Benth.; Watson, *l. c.* p. 478).—Utah, 1871, 1872, Watson's Report.

ERIOGONUM HERACLEOIDES, Nutt. (Watson, *l. c.* p. 299).—Utah, 1871, 1872, Watson's Report.

ERIOGONUM UMBELLATUM, Torr. (Watson, *l. c.* p. 300).—Utah and Nevada, 1871, 1872, Watson's Report; South Park, Colorado, 1873, Wolf (24).

ERIOGONUM OVALIFOLIUM, Nutt. (Watson, *l. c.* p. 301).—Northern Nevada, 1871, 1872, Watson's Report.

ERIOGONUM PAUCIFLORUM, Pursh.—Low, cæspitose; branches of the caudex very short and crowded; leaves linear or subspatulate, revolute-margined, attenuated into a petiole, at length nearly smooth; scape 4 to 6 inches high, bearing a single head; involucres 5 to 10, turbinate-campanulate, 5-toothed; calyx white, glabrous, lobes oval; filaments pubescent below.—Torr. & Gray, Rev. Eriog. Proc. Am. Acad. 8, p. 166.—Sulphur Springs, South Park, Colorado, August, 1873, Rothrock (27).

ERIOGONUM ELATUM, Dougl. (Watson, *l. c.* p. 302).—Nevada, 1871, 1872, Watson's Report (260).

ERIOGONUM FASCICULATUM, Benth., var. POLIFOLIUM, Gray (Watson, *l. c.* p. 302).—Nevada, 1871, 1872, Watson's Report.

ERIOGONUM CORYMBOSUM, Benth. (Watson, *l. c.* p. 303).—Arizona, 1871, 1872, Watson's Report.

ERIOGONUM MICROTHECUM, Nutt. (Watson, *l. c.* p. 303).—Utah, 1871, 1872, Watson's Report; also var. EFFUSUM, T. & G., Arizona, and a form between var. CONFERTIFLORUM, T. & G., and var FENDLERIANUM, Benth., but with larger flowers than usual. Var. EFFUSUM, T. & G., Upper Arkansas, Colorado, September, 1873, Wolf (22).

ERIOGONUM BREVICAULE, Nutt. (Watson, *l. c.* p. 304).—Utah, 1871, 1872, Watson's Report.

ERIOGONUM RACEMOSUM, Nutt. (Watson, *l. c.* p. 304).—Nevada and Utah, 1871, 1872, Watson's Report.

ERIOGONUM WRIGHTII, Torr. (Watson, *l. c.* p. 305).—Sanoita Valley, Arizona, at 5,850 feet elevation, August, 1874, Rothrock (593), and Camp Grant, September (726).

ERIOGONUM GRACILE, Benth., var. EFFUSUM, T. & G. (Watson, *l. c.* p. 305).—Nevada, 1871, 1872, Watson's Report.

ERIOGONUM HERMANNI, Dur. & Hilg. (Watson, *l. c.* p. 306).—Nevada, 1871, 1872, Watson's Report.

ERIOGONUM DEFLEXUM, Torr. (Watson, *l. c.* p. 306).—Arizona, 1871, 1872, Watson's Report.

ERIOGONUM CERNUUM, Nutt. (Watson, *l. c.* p. 308).—Twin Lakes, Colorado, July, 1873, Wolf (23). Var. TENUE, T. & G., Nevada, 1871, 1872, Watson's Report.

ERIOGONUM TRICHOPODUM, Torr. (Watson, *l. c.* p. 309).—Ash Creek, Arizona, at 3,080 feet elevation, July, 1874, Rothrock (332).

ERIOGONUM INFLATUM, Torr. (Watson, *l. c.* p. 309).—Nevada and Arizona, 1871, 1872, Watson's Report.

ERIOGONUM ABERTIANUM, Torr. (in Emory's Reconn. p. 151; Torr. & Gray, Proc. Am. Acad. 8, p. 189).—Villous or loosely and softly pubescent, paniculately branched, 1 to 1½ feet high; branches erect, often leafy almost to the apex; lower leaves ovate or subcordate, petioled, often undulate, those of the branches lanceolate or linear, subsessile; involucres more or

less peduncled, many-flowered, deeply 5- to 8-cleft, lobes foliaceous; calyx petaloid, glabrous, rose-colored, outer segments rounded, deeply cordate, becoming nearly 2 lines long, the inner linear-oblong, retuse.—Cottonwood, Arizona, at 4,750 feet elevation, July, 1874, Rothrock (355).

ERIOGONUM PHARNACEOIDES, Torr. (in Sitgreaves's Rep. p. 167, t. 11; Torr. & Gray, *l. c.* p. 189).—Pubescent, very slender, effusely panicled, 1 foot high; internodes elongated; cauline leaves narrow-linear, sometimes revolute on the margins, hoary-tomentose beneath, becoming glabrous above, about 1 inch long; pedicels capillary, smooth, 1 to 2 inches long; involucres 5- to 8-cleft, 8- to 12-flowered, bracteoles filiform, villous; calyx petaloid, glabrous, white or rose-colored, outer segments broadly ovate, concave, in fruit bi-gibbous at base, the inner longer, oblong-linear, retuse; anthers dark.—Arizona, 1873, Loew (154 *a*). Var.—Taller, 12 to 18 inches high, softly villous-pubescent throughout; branches much stouter and erect; lower leaves ovate-lanceolate; heads and flowers larger.—Sanoita Valley, at 5,850 feet elevation, September, 1874, Rothrock (664).

CHORIZANTHE RIGIDA, Torr. (Watson, *l. c.* p. 312).—Nevada or Arizona, 1871, 1872, Watson's Report.

OXYRIA DIGYNA, Campd. (Gray's Man. p. 419).—South Park, Colorado, July, 1873, Wolf (42).

RUMEX OCCIDENTALIS, Watson, Proc. Am. Acad. 12, p. 253 (*R. longifolius*, DC., Watson, *l. c.* 314).—Twin Lakes and San Luis Valley, Colorado, 1873, Wolf (29, 33).

RUMEX SALICIFOLIUS, Weinm. (Gray's Man. p. 420).—San Luis Valley, Colorado, 1873, Wolf (31). Var. with lance-ovate leaves and inner valves of the calyx larger and broad-cordate, Cienega, Arizona, August, 1874, Rothrock (564).

POLYGONUM AVICULARE, Linn.—Utah, 1871, 1872, Watson's Report; Twin Lakes, Colorado, 1873, Wolf (34, 35).

POLYGONUM ERECTUM, Linn.—Utah, 1871, 1872, Watson's Report; San Luis Valley, Colorado, 1873, Wolf (41).

POLYGONUM TENUE, Michx., var. LATIFOLIUM, Engelm.—Mount Graham, Arizona, at 9,000 feet elevation, 1874, Rothrock (758); Upper Arkansas, Colorado, 1873, Wolf (39).

Polygonum imbricatum, Nutt. (Watson, in Am. Naturalist, 7, p. 665).—Low, 1 to 8 inches high, slender, often diffusely branched, smooth; spikes short, dense; bracts loosely imbricated, linear or oblong, 2 to 4 lines long, with sometimes a narrow scarious margin, acute; sepals colored; stamens 3 or 5; styles one-third as long as the ovary; achenium glabrous.—South Park, Colorado, July, 1873, Wolf (36).

Polygonum amphibium, Linn.—Utah, 1871, 1872, Watson's Report; Colorado, 1873, Wolf (38).

Polygonum amphibium, L., var. Muhlenbergii, Meisn. in DC. Prod. 14, p. 116—Camp Crittenden, Arizona, at 5,000 feet elevation, September, 1874, Rothrock (670). As in some of our Eastern specimens, the peduncles are glandular-scabrous.

Polygonum Persicaria, Linn.—Utah, 1871, 1872, Watson's Report. Introduced.

Polygonum nodosum, Pers. (Meisner in DC. Prod. 14, p. 118)—Stem with the nodes much enlarged, 2 to 6 feet high; ochreæ loose, becoming glabrate, minutely ciliolate; leaves oblong or lanceolate, glandular-punctate beneath, the lowest short-oval or ovate, the highest linear, the middle ones 6 to 8 inches long and 1 to 2 wide, tapering into a long acumination; spikes racemose, linear, attenuated upward, loose, nodding, on glabrous peduncles; bractlets ovate, acute, naked, longer than the pedicels; calyx flesh-colored or white, without glandular dots, slightly nerved, including the 6 stamens and 2-parted style; achenium lenticular, rarely triangular.—San Luis Valley, Colorado, September, 1873, Wolf (40); Zuñi Village, New Mexico, at 6,500 feet elevation, July, 1874, Rothrock (160); Camp Lowell, Southern Arizona, August, 1874, Rothrock (702).

Polygonum Hydropiper, Linn.—Sanoita Valley, Arizona, at 4,500 feet elevation, September, 1874, Rothrock (688). Introduced?

Polygonum viviparum, Linn.—South Park, Colorado, July, 1873, Wolf (43).

Polygonum Bistorta, Linn.—South Park, Colorado, July, 1873, Wolf (44). Var. oblongifolium, Meisner, Willow Spring, Arizona, at 7,202 feet elevation, July, 1874, Rothrock (228).

AMARANTACEÆ.

GOSSYPIANTHUS* RIGIDIFLORUS, Hook.—Stem prostrate, diffusely branched; cauline leaves secund, 2–4″ long, 1–2″ wide, acute, tapering to a rather broad base; flowers in axillary clusters; sepals membranous; filaments a little longer than the oblong anthers; stigma 2-lobed.—Camp Bowie, Arizona, on limestone soil (507). Whole head of flowers densely covered with long cottony hairs, which, under a low-powered objective, are found to be transparent, jointed, and slightly swollen at the proximal side of the joint on account of the granular matter which accumulates there.

ALTERNANTHERA LANUGINOSA, Torr.—Arizona (557). Apparently an excessively variable plant, so far as my imperfect specimens enable me to decide.

NITROPHILA OCCIDENTALIS, Watson (Banalia, Moq.).—Nevada.

GOMPHRENA NITIDA.—Erect, 6–14′ high, branching from the axils; branches sometimes nearly as long as the main stem; stem and branches somewhat silky-hairy; leaves oblong-spatulate, 1–3′ long, 4–8″ wide, obtuse, mucronulate, cinereous, somewhat silky (younger ones densely so, and under an inch objective the hairs are seen to be beautifully jointed); heads sessile or nearly so, pearly-white (no trace of red), subtended by two (or more) large leaves; bracts membranous, usually somewhat lacerate-toothed or crested on the back, broadly lanceolate, tapering into a very acute point; sepals very acute, membranous, abundantly hairy below and outside, somewhat shorter than the bracts; stamineal tube united to the top, middle lobe of the filament nearly obsolete, anthers oblong; style three-fourths as long as the tube.—Chiricahua Mountains, in Southern Arizona, on rocky knolls (520). The hair on the back of the sepals is (under a moderate power) seen to be quite long comparatively, and with the peculiar

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* GOSSYPIANTHUS, Hook.—Flowers hermaphrodite [2–3-bracted]. Calyx of 5 erect, subequal, very villose sepals. Stamens 5, free. Filaments subulate. Anthers unilocular, ovate. Single-celled ovary with one ovule. Style very short, roundish. Stigma emarginate, 2–3-lobed. Single-seeded utricle ovate, valveless, included in the calyx. Seed vertical, ovate-lenticular, sub-reniform; testa crustaceous. Embryo coiled around the central, farinaceous albumen; radicle ascending.—North American perennial herbs, with procumbent, flexuose, woolly stems. Radical leaves petioled or sub-sessile, obovate or elongated-spathulate, rigid, sub-coriaceous; cauline opposite, sessile, much smaller, ovate, entire, more or less silky-woolly. Flowers axillary, densely aggregated, covered with copious flexuose wool, the deciduous, delicate bracts keeled and concave.—Moquin, DC. Prod. 13, pars 2, p. 337.

twist of the cotton fibre, though, of course, too scant and short to be utilized. I am indebted to Mr. Watson for the following statement:

"It is the same as 1751 Wright, 946 and 1013 Thurber, 191 Wislizenus; also collected by Coulter and Berlandier. It is *G. globosa*, var. *albiflora*, Moq. in Bot. Mex. Bound. It is (without critical comparison), however, very much nearer *G. decumbens*, but has acuter bracts."

I am led to regard it as distinct from *globosa*, var. *albiflora* (which is "*G. eriopoda*, Gillies in Herb. Hook"), and certainly it is not *G. decumbens*, as in the latter only the interior sepals are silky, and the outer ones are obtuse, whereas in my specimens all are silky and acute.

FRŒLICHIA* FLORIDANA, Moq.—Cinereous-tomentose or woolly, erect, 1–3° high. Stem leafy below, nearly naked above; radical leaves lanceolate, obtuse, on rather long petioles; inflorescence in racemose spikes 6–12″ long, and covered with a fulvous wool; bracts dark, shorter than the calyx, which is woolly when young and hardens with age, becoming flattened, cristate and tuberculate at the base.—Camp Bowie, Arizona (488).

AMARANTUS FIMBRIATA, Benth. (*Sarratia Berlandieri*, var. *fimbriata*, Torr. in Bot Mex. Bound. p 179. *Amblogyne fimbriata*, Gray, Proc. Amer. Acad. v, p. 168).—"Stem and branches virgate; leaves linear-lanceolate, the globose glomerules sessile in the axils of the leaves, and in nearly leafless spikes above, approximate or crowded, the pointless bracts shorter than the calyx; sepals of the male flowers obtuse, of the female connate, subequal, narrowed at the base, flabelliform-cuneate, at the apex dentate-fimbriate, widely spreading in fruit. Utricle circumcissile."—Nevada and Arizona.

AMARANTUS TORREYI, Benth. (*Sarratia Berlandieri, cum var. emarginata*, Torr. *l. c* *Amblogyne Torreyi*, Gray, Proc. Amer. Acad. v, p 169).—"Dicœcious, leaves ovate-oblong or oblong-lanceolate; glomerules paniculate-spiked and axillary; bracts and sepals of the male flowers cuspidate-acuminate. Sepals of the female flowers united below, equal, obovate-

* FRŒLICHIA, Mœnch.—"Flowers perfect, 3-bracted. Calyx tubular, 5-cleft, indurated and spiny-crested in fruit. Stamens 5, united into a long tube. Sterile filaments entire, anthers sessile. Stigma capitate or many-cleft. Utricle indehiscent, 1-seeded, included in the calyx. Seed vertical. Radicle ascending. Woolly or hairy annuals. [My specimens appear to have a biennial or perennial root.] Leaves opposite. Spikes opposite, and terminating the naked peduncle-like summit of the stem."—**Chapman's Flora of the Southern United States, p. 383.**

spatulate, the single nerve simple or slightly pinnately branched, apex round, entire, retuse or emarginate. Utricle circumcissile."—San Francisco Mountains, Arizona. Not having access to specimens, I have quoted the description of this and the preceding species mainly from Gray, *l. c.*

AMARANTUS (AMBLOGYNE) PALMERI, Watson (Proc. Amer. Acad. xii, p. 274).—Dicœcious, erect, branching, smooth or nearly so; leaves oblong-ovate or rhombic-ovate, somewhat shorter than the slender petioles, entire or undulate, the upper ones sometimes linear-lanceolate; flowers in axillary clusters or elongated leafy spikes; male flowers with sepals one-nerved, acute, nearly equal, slightly exceeding the stamens; anthers introrse, fixed in a versatile way to the short filament; cells *somewhat* diverging below; bracts membranaceous, oval, and with a long awn-like tip, exceeding the calyx; female flowers with sepals distinct or nearly so, membranaceous, unequal—*i. e.*, two larger and conspicuously tipped with an awn-like point, the others oblong, obtuse, retuse, entire, or somewhat dentate-fimbriate; stigmas 2 or 3; bracts much longer than the flowers, terminating in a stout, somewhat recurved, awn.—Camp Grant, Arizona (379).

AMARANTUS WRIGHTII, Watson (Proc. Amer. Acad. xii, p. 275).—Smooth or nearly so, erect, simple or branching; leaves lanceolate to oblong, obtuse, 4–8″ long, equalling the petioles; leafy spikes compound, short branchlets (of spike) zigzag, very slightly margined; sepals of fertile flower equal, obtuse, thickened, and somewhat gibbous at base, a little exceeding the utricle; stigmas 3; seeds black or brown, orbicular; subulate bracts rigid.—Valley of the Upper Arkansas, Colorado (275).

AMARANTUS RETROFLEXUS, L.—Twin Lakes, Colorado (274).

AMARANTUS ALBUS, L.—Arizona and Utah.

CHENOPODIEÆ.

SARCOBATUS VERMICULATUS, Torr.—"Chico," Utah; San Luis Valley, Colorado, common (265, 266). New Mexico (87, and by Loew 265). Male flowers, Utah.

SUÆDA DIFFUSA, Watson (*Suæda maritima*, Watson, in King's Report 5, 294).—Growing 4 feet high, abundantly, on the banks of the Gila River in Arizona (773); also from Nevada and Utah

SUÆDA DEPRESSA, Watson.—Salt-works in South Park, Colorado (267); and also the var. ERECTA, Watson, 1–2° high, branches short and leaves narrow (276), South Park.

TELOXYS* CORNUTA, Torr.—Erect, low herb, simple or branched; leaves (with petiole) 6–18″ long, lanceolate, sinuate-pinnatifid, the usually perfect flowers ½–1″ in diameter; calyx resinous-dotted and the lobes keel-crested.—Mount Graham, Arizona, at 9,000 feet elevation (737).

KOCHIA AMERICANA, Watson (Proc. Amer. Acad. ix, p. 93).—Nevada.

CHENOPODIUM FREMONTII, Watson.—Twin Lakes, Colorado (253); Mount Graham, Arizona, at 9,000 feet elevation (747); Utah.

CHENOPODIUM ALBUM, L.—Colorado, Arizona, New Mexico, and Utah.

CHENOPODIUM OLIDUM, Watson (*Chenopodium album*, in King's Report v, p. 287 in part).—Differs from *C. album* in the smaller leaves, the more loosely panicled, close clusters of flowers, and in the large seed being closely adherent to the calyx.—Twin Lakes, Colorado (258).

CHENOPODIUM AMBROSIOIDES, L., var. ANTHELMINTICUM, Gray.—Old Camp Goodwin, Arizona, at 3,000 feet elevation (343).

CHENOPODIUM LEPTOPHYLLUM, Nutt. (*Chenopodium album*, var. *leptophyllum*, in King's Report, v, 287).—Valley of the Arkansas, Colorado (264).

BLITUM† RUBRUM, Reich., var. HUMILE, Moquin (*Blitum polymorphum*, var. *humile*, in King's Report, vol. v, p. 288).—Hot Springs of San Luis Valley, Colorado (water about 80° Fahr.) (272).

BLITUM CAPITATUM, L.—Colorado (269, 271).

BLITUM GLAUCUM, Koch (*Chenopodium glaucum*, L, Gray's Man.).—Colorado (260, 261, 254).

MONOLEPIS CHENOPODIOIDES, Moq.—Twin Lakes, Colorado (256).

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* TELOXYS, Moquin.—"Flowers perfect or sometimes pistillate. Calyx 5- (rarely 4-) parted, the lobes more or less prominently carinate and subcrested. Stamen 1 (5, Moquin) or wanting. Ovary ovate: styles 2, free or united at base. Fruit partially covered by the loosely appressed calyx; pericarp membranous. Seed lenticular, with a crustaceous testa.—Herbaceous annuals, erect and diffuse; the minute solitary flowers very shortly pedicelled, axillary and terminal upon the repeatedly dichotomous nearly naked branches; terminal flowers abortive and deciduous, leaving the ultimate branchlets spinulose; leaves thin, alternate."—WATSON, Revision of North American Chenopodiaceæ, Proc. Amer. Acad. vol. ix, p. 90.

† BLITUM differs from CHENOPODIUM in having the seed vertical and the calyx destitute of appendages.

ATRIPLEX* PATULA, L., var. HASTATA, Gray, Colorado (262, and 259 in part); var. LITTORALIS, Gray, Colorado (259 in part).

ATRIPLEX EXPANSA, Watson (Proc. Amer. Acad. ix, p. 116).—Annual, erect, much branched; leaves almost sessile, thin, ovate-triangular, or subhastate at base, lower ones opposite; fruiting bracts nearly sessile, broadly cuneate or roundish, distinctly reticulate or muriculate and pale below, herbaceous and irregularly toothed along the free, herbaceous margins, united to above the middle; the interrupted staminate spikes slender and naked above.—A common straggling species growing abundantly on the alkaline flats of the San Luis Valley, Colorado (278).

ATRIPLEX WOLFII, Watson, *l. c.* p. 112.—Annual, low, scurfy-pubescent, branching, reddish; leaves linear, entire, thickish, margins slightly revolute; "androgynous axillary clusters of flowers very small"; fruiting bracts $\frac{3}{4}''$ long and as broad, united to the top; upper lateral teeth thick, slightly truncate, middle one smaller and somewhat acute; styles short.—San Luis Valley, Colorado (277).—PLATE XXIV. Natural size. Fig. 1. Staminate flower, about 12–15 diameters. 2. Pistillate flower, about 10 diameters. 3. Pistil, about 10 diameters. 4. Section through figure 2. Figs. 5, mature fruit; 6, vertical section of same; 7, annular embryo; all enlarged about 10 diameters.

ATRIPLEX CONFERTIFOLIA, Watson (*Obione confertifolia*, in King's Report, v, 289).—Nevada and Utah.

ATRIPLEX HYMENELYTRA, Watson (*Obione hymenelytra*, Torr. in King's Report, v, p. 290).—Nevada.

ATRIPLEX CANESCENS, James (*Obione canescens*, Moq.).—This is the 982 in vol. v, King's Report, p. 289, but not 981 of same place. It differs from the latter, which is *A. Nuttallii*, Watson, in having the indurated, fruiting bracts united to the apex, contracted above to a narrow orifice and pedicelled, and not muriculate; the fruiting bracts of *A. Nuttallii*, Watson, being united to above the middle, the orifice hardly contracted, and the sides usually muriculate-toothed, and fruit mostly sessile. See Watson, Revis. Chenopod. *l. c.* p. 120.—Colorado (268). Specimens from New Mexico,

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* ATRIPLEX.—"Bracts compressed, more or less united: testa double"—WATSON, Revision of N. Am. Chenopod. *l. c.*

too young, and in doubt placed here (126, 112), were much frequented by a large black insect an inch or more long. Attached to these were some flies engaged in sucking the juices of the larger insect.* We found many of the flies still active and adhering to their defunct victims.—Southern Arizona (555, 556); Nevada.

EUROTIA LANATA, Moq.—Common throughout the West, where it goes among the herdsmen under the name of White Sage and Winter-fat,—a really valuable forage eagerly eaten by stock.

CORISPERMUM HYSSOPIFOLIUM, L.—Colorado (37, 866, 872).

SPIROSTACHYS OCCIDENTALIS, Watson (*Halostachys occidentalis*, Watson in King's Report, v, 293).—Nevada, Arizona, and Utah.

PARONYCHIEÆ.

PARONYCHIA PULVINATA, Gray.—South Park, Colorado, at 12–13,000 feet elevation (46).

ELÆAGNEÆ.

SHEPHERDIA CANADENSIS, Nutt.—Colorado (58, 59).

ELÆAGNUS ARGENTEA, Pursh.—Colorado (60).

URTICEÆ.

CELTIS RETICULATA, Torr. (Ann. N. Y. Lyc. 2, 247, and Nutt. Sylva, 1, 133, t. 39).—Leaves somewhat acute, obliquely cordate-ovate, and the nearly entire margins somewhat revolute; veins strongly reticulated on the lower surface and deeply impressed on the upper, papillose-scabrous above, less rough below; fruiting pedicels longer than the petioles; the pisiform berry glaucous, with a somewhat reticulate-rugose nucleus.—Nevada. Not having seen a specimen, I have drawn this description largely from Planchon, in DC. Prod. 17, p. 178.

Number 367, from Camp Grant, Arizona, Mr. Watson regards as a new species, for which he has indicated the name of *C. curtipes*. I do not feel like attempting a description from the material at hand. It is a tree 20 feet high, with a diameter of 18 inches, and has a smoothish, white bark.

URTICA GRACILIS, Ait., San Luis Valley, Colorado (71), and U. GRACILIS,

*Since this observation was made in 1874 the relations existing between insects and flowering plants have come to be more generally acknowledged, because more fully understood. I now suspect that the case given above has a deeper history than appears on the surface.

Ait., var. OCCIDENTALIS, Watson (*U. dioica*, L., var. *occidentalis*, Watson, vol. v, King's Report, p. 321), Utah.

URTICA DIOICA, L.—Western New Mexico, Loew.

URTICA BREWERI, Watson (Proc. Amer. Acad. x, p. 348).—Perennial, erect, rather slender, spinulose; leaves quite thin, very coarsely and somewhat irregularly toothed, 3–5′ long, 1–1½′ wide, cuneate, rounded, or subcordate at base; petioles slender, 1½–3′ long; flowering panicles loose, about as long as the petioles; ovate achenium ½′ long, included in the obovate, hispid perianth. Very variable.—Southern Colorado (71).—PLATE XXV. Natural size. Fig. 1. Staminate flower. Fig. 2. Pistillate flower. Fig. 3. Achenium, enclosed by the large inner sepals. Fig. 4. Calyx opened, showing mature achenium. All enlarged about 10 diameters.

HUMULUS LUPULUS, L.—Utah and Colorado (53).

BETULACEÆ.

BETULA OCCIDENTALIS, Hook.—Northern Nevada, Utah, and Colorado (841).

BETULA GLANDULOSA, Michx.—Colorado (838, 839).

ALNUS INCANA, Willd., var. GLAUCA, Ait.—Arizona, Utah, and Colorado (840).

ALNUS OBLONGIFOLIA, Torr. (in Bot. Mex. Bound. p. 204).—"Branches smooth and shining; leaves oblong-lanceolate, acute at each end, somewhat doubly serrate, smooth above and minutely pubescent beneath, with surfaces green; nutlets wingless. Tree 30° high. Leaves 2½–3½′ long and 1–1½′ wide, unequally serrate, serratures glandular at the tip. Petiole about one-third as long as the lamina. Catkins somewhat paniculate, ovate. Nutlets orbicular-obovate, without any trace of a wing." I have not seen the plant, and hence have quoted the above from Bot. Mex. Bound. *l. c.*—Arizona.

PLATANEÆ.

PLATANUS RACEMOSA, Nutt.—Leaves broadly cordate, deeply 5-cleft, divisions sharp pointed, lanceolate, the lower smaller, sometimes only 3-cleft from suppression of the lowest lobes. Upper surface at first covered with branching, yellow hairs; under surface always whitish woolly; fertile

heads in long, drooping racemes, 3–5. Styles long; "stigmas at first of a deep and bright brown."—Arizona.

SALICACEÆ.

SALIX* AMYGDALOIDES, Anders. (Sal. Bor.-Amer.) (*S. nigra*, Marsh, var. *amygdaloides*, Anders. DC. Prod. 16, 2, 201.)—Leaves broadly lanceolate, 3–6′ long, ½–1½′ wide, with a long tapering point, glaucous beneath, closely serrate, petioles long and slender, stipules minute and very early deciduous: aments leafy-peduncled, elongated-cylindrical, pendulous; the fertile when in fruit lax, 3–4′ long, ½′ thick; scales in the male ament ovate, villous with crisp hairs, in the female narrower, somewhat smooth, fugacious: capsules globose-conical, glabrous, long-pedicelled; style very short or obsolete, stigmas notched. Denver, Colorado (823). From Utah to Missouri; frequent along the Platte; northward to Red River and eastward to the shores of Lake Erie. In aspect very unlike *S. nigra*, and in fact more frequently mistaken for *S. lucida*. The broad leaves, being supported by long and slender petioles, are moved by the slightest breeze, displaying in rapid, fluttering succession their conspicuous white under surfaces, thus producing an effect in striking contrast with the changeless, soft light reflected from masses of the foliage of *S. nigra* when swayed gently by the wind.

SALIX LONGIFOLIA, Muhl.—Santa Fé, N. Mex., Denver, Colo., June (822).

SALIX ROSTRATA, Richards. (*S. livida*, Wahl., var. *occidentalis*, Gray. *S. vagans*, var. *rostrata*, Anders.)—South Park (821); Georgetown (number 826 in part); Arizona.

SALIX NOVÆ ANGLIÆ, Anders., var. PSEUDO-CORDATA, Anders. (Sal. Monogr. 161, and DC. Prod. 16, 2, 253).—Leaves oblong-lanceolate, acute or acuminate, the earliest obovate-oblong and somewhat obtuse, closely and slightly serrulate or crenate, bright green and glabrous on both sides, reticulate-veined, the young drying black, stipules on vigorous shoots large, semicordate, on twigs and flowering branches small or none; aments short, oblong-cylindrical, about 1′ long, densely flowered, at first wrapped in the

* For the elaboration of this genus I am indebted to Mr. M. S. Bebb, who, more than any other American, is placing our knowledge of this most difficult group on a satisfactory basis.

leaves of the short peduncle; scales obovate, black, villous with white hairs; capsules conic-rostrate, glabrous; pedicels about twice the length of the nectary; style medium-sized, pale, stigmas entire, erect. South Park, Colorado (825); also Georgetown (826 in part). Differs from *S. cordata* in the more compact aments, subsessile capsules, and leaves green on both sides and slightly crenate—not glandular-serrate. Apparently a common willow in the Rocky Mountains of Colorado, having been collected there by Hall, Greene, Porter, Patterson, Brandegee, and others. Under the inappropriate name of *S. Novæ Angliæ* (for British American), Professor Andersson has arranged a series of forms, intermediate, as it were, between our *S. cordata* and *S. Myrsinites* of Northern and Arctic Europe and Asia, probably including several good species, which, with better material, may hereafter be separated.

Salix desertorum, Richardson (DC. Prod. 16, 2, 281; Porter, Fl. Col. 128).—Leaves narrowly oblong, rigid, more or less whitish-tomentose beneath; aments very short, subglobose, densely flowered; scales pale rose-color, densely white villous; capsules ovate-conical, white-woolly, sessile; style 2-parted, brown. A low, scraggy, much branched shrub, rising to the height of two or three feet, or even more, when it descends into the valleys.—South Park, Colorado, June (819, 829). To this species should be referred Hall & Harbour's No. 523 (very similar to Drummond's No. 657) and most of the so-called *S. glauca* of the Colorado Mountains.

Salix Wolfii, Bebb, sp. nov.—Leaves oblanceolate, or the lower narrowly oblong, acute, entire, silky when young, with a tendency to blacken in drying, at length smooth, rigid, and green on both sides; stipules none; aments small, subglobose (less than $\frac{1}{2}'$ long), densely flowered, scarcely peduncled, with 3–4 bracts at base, which exceed in length the mature, fertile ament; scales obtuse, black, very sparingly villous; capsules conical, from an ovate base, pointed, glabrous, subsessile, greenish or dull red; pedicels barely equalling the gland; style slender, greenish or dull; stigmas small, bifid or entire.—South Park, Colorado (820, 824, 828; also collected by Dr. Parry on Wind River, 263, in Captain Jones's Wyoming Expedition, 1873). Resembles the foregoing in habit and in the form of the leaves and aments, but distinguished by the perfectly

smooth, reddish capsules, the black, scantily villous scales, and the leaves colored alike on both sides; aments somewhat as in *S. Novæ Angliæ*, var. *pseudo-myrsinites*, Anders., but that has beaked capsules and glabrous, crenate leaves, which are membranous in texture and prominently reticulate-veined.

SALIX RETICULATA, L. (Watson, vol. v, King's Report, p. 327; Porter, Fl. Col. 128).—Half Moon Creek, Colorado, at 13,000 feet elevation (830).

POPULUS MONILIFERA, Ait.—Nevada.

POPULUS BALSAMIFERA, L., var. ANGUSTIFOLIA, Watson.—Nevada and Utah, and San Luis Valley and Denver, Colo. (833, 834). Var. *candicans*, Gray, Colorado (835).

POPULUS TREMULOIDES, Michx.—San Francisco Mountains, Arizona; also South Park, Colorado (832).

POPULUS ANGULATA, Ait.—Denver (831).

EUPHORBIACEÆ.

BY DR. GEORGE ENGELMANN.

CROTON CORYMBULOSUS.—Many erect stems from a ligneous base, a span to a foot high, simple below, branching upward; stipules subulate, deciduous; petioles about half as long as the oval or oblong, mostly acutish, leaves, which are $\frac{3}{4}$–$1\frac{1}{4}'$ long, the lowest ones broader and shorter and often acutish at base, all triplinerved at base, penninerved upward, whitish below, greenish-gray above; stellate hairs slightly united to scales above, almost free and loose below; inflorescence short, loose-flowered, corymb-like, 6–8″ wide, mostly monœcious; pedicels 2–3″ long, much longer than the flowers; male flowers with 5 spatulate or lanceolate bearded petals alternating with the 5 lobes of the disk; 6–13 stamens with bearded filaments; female flowers mostly apetalous; styles bifid to below the middle or usually to the base, and together with the ovary and the oblong (3″ long) capsule stellate scaly; seeds linear-oblong, 2″ long, delicately punctate-reticulate.—Camp Bowie, New Mexico, Rothrock, 1874 (506). Through Western Texas (Wright, 641, 1805) into Mexico (Saltillo and Buena Vista, Gregg, 71, 288). This species was first described by Torrey in Bot. Mex. Boundary, p. 194, under the name of *C. Lindheimerianus*, in which Müller, DC. Prod. 15, 2, 579, followed him. But Scheele's plant thus named and described in

Linnæa, 25, 580, is an annual, mistaken by him for a shrub, which was collected by Lindheimer near New Braunfels, Tex., in 1846, and distributed in his sets under No. 526, and lately rediscovered along a railroad in the Indian Territory by G. D. Butler. This plant was by Müller taken for Nuttall's *C. ellipticus*, from Saint Louis, which is, however, identical with *C. monanthogynus*, Michx., and in Gray's Manual, ed. 5, 438, the same species was again described as *C. eutrigynus*.

Croton Texensis, Müll. *l. c.* 692.—An annual, erect, diœcious plant of the southwestern plains, Texas and New Mexico, 1–3° high, canescent or greenish-gray (when it is *C. virens*, Müll. *l. c.* 690), with linear-oblong leaves 2½′ long on petioles ¼–½′ long, without any glands; stellate hair free, not scaly; flowers apetalous; stamens usually 10–13; filaments hairy; styles twice or thrice 2-cleft at base, and, like the capsules, stellate-canescent; seeds orbicular-ovate, somewhat compressed, with a small deciduous caruncula below the apex.—Santa Fé, N. Mex., Rothrock, 1874 (37), originally described by Nuttall as *C. muricatus*, a name already preoccupied. *Hendecandra Texensis*, Klotzsch, and *H. multiflora*, Torr., are other synonyms for this plant. Nuttall's name refers to the curious knobs or almost spines on the capsule, which are covered with prominent tufts of stellate hairs. The styles are twice or often three times cleft, so that there are 12 to 24 stigmas.

Acalypha Lindheimeri, Müll. *l. c.* 875.—Many weak, ascending, downy stems from a thick ligneous root, a span to a foot high, branching from the base: leaves lanceolate-ovate, acute at both ends, serrate upward, hairy, on short petioles, lower ones broader and shorter; slender, dense-flowered, terminal spikes 2–3′ long, staminate upward; shorter spikes from the uppermost leaf-axils; bracts oval, deeply dentate; styles divided into many very slender, long-protruding, red branches.—Ash Creek, Arizona, Rothrock, 1874 (299), and through New Mexico to Western Texas.—Very near the Mexican *A. phleoides*, Cav., with which Torrey, Bot. Mex. Bound. 199, was inclined to unite it. The slender spikes with the delicate bright red fringes give the plant a very elegant appearance.

Jatropha macrorhiza, Benth. Pl. Hartw. 8; Müll. *l. c.* 1087, var. septemfida.—Stems a span to a foot high, glabrous, very leafy; leaves

glabrous, with the nerves of the upper surface puberulent, cordate, with an acute sinus, broader than long, divided about $\frac{3}{4}$ or more into 7 ovate or ovate-lanceolate, incisely dentate, aristate lobes; stipules (2–3″ long) setaceously divided; petioles about $\frac{1}{2}$–$\frac{3}{4}$ the length of the leaf; cymes densely many-flowered, short-peduncled, somewhat puberulent, with subulate-setaceous, entire, or the lower ones setaceously ciliate, bracts; sterile flowers $\frac{1}{2}'$ long, with lanceolate, aristate, usually entire calyx-lobes, half as long as the spatulate petals; 5 (or rarely 6) exterior and 3 longer interior stamens, all united to about half their length, bearing equal, linear-oblong anthers; calyx-lobes of fertile flowers broader, larger, spinulose-dentate; styles 3, each with 2 oblong stigmas; capsule obtusely triangular, oblong, $\frac{1}{2}'$ or more long; seeds linear-oblong (4–5′ long), with a large hoodlike, cut-fringed caruncle.—Sulphur Springs, Arizona, Rothrock, 1874 (546), and to Southern New Mexico and Chihuahua, Wislizenus. Leaves in the smallest specimens (Wislizenus, Chihuahua) 2′ long by $2\frac{1}{2}'$ wide, in Rothrock's largest 6′ by 8′, always with 7 lobes and usually with 2 smaller additional ones at base. Evidently a form of the Mexican *J. macrorhiza*, and with the same curious caruncle of the seed, distinguished by the longer petioles, the much more deeply divided leaves, with more numerous and more deeply cut-toothed lobes, and an acute (not wide or truncate) sinus Torrey's, *J. multifida*, Bot. Mex. Bound. p. 198 (not Linn.), is evidently the same thing, as already suggested by the author himself, and probably nearer Bentham's type than our plant, as the leaves are said to be only 3–5-lobed.

Euphorbia (Anisophyllum) albomarginata, Torr. & Gray in Pacif. R. R. Report, 2, 174; Bot. Mex. Bound. 186; Boissier in DC. Prod. 15, 2, 30.—A prostrate, much branched, glabrous, glaucous perennial, with orbiculate-cordate, entire, rather fleshy leaves (2–3″ wide) and conspicuous, triangular, membranaceous, whitish stipules; involucres axillary, solitary, or sometimes crowded into foliaceous cymules, broadly campanulate with conspicuous, white, transverse, entire or undulate appendages of the glands; capsules triangular; seeds reddish-gray, linear or oblong, smooth or sometimes very slightly undulate.—Zuñi, Rothrock (173 *in part*), 1874, to Fort Tejon, California (274), 1875, and generally from Western Texas to Southern California and into adjoining Mexico. A very distinct species, easily

recognized by its glaucous color and whitish stipules and white appendages. In Arizona it is called "Rattlesnake-weed", as its acrid juice is considered an antidote against the venom of that reptile. In Mexico, to this, as well as to other allied species, known under the name of *Golondrina*, great medicinal virtues are ascribed.

Euphorbia (Anisophyllum) flagelliformis, Engelm. in Hayden's Bull. Geol. and Geog. Surv. Terr. 2, No. 3, 243. *E. petaloidea*, var. *flagelliformis*, Engelm. in Bot. Mex. Bound. 185. *E. zygophylloides*, var. *flagelliformis*, Engelm. in Boiss. *l. c.* 29.—A glabrous annual, with prostrate or ascending branches a span to a foot long; linear or oblong-linear entire leaves, acutish at both ends, 4–6″ long, 1″ wide; conspicuous triangular incised stipules and alternate loose-flowered leafy corymbs; involucres broadly campanulate, with 2–4 large, concave, narrow-margined or inappendiculate glands; broad triangular capsule; smooth gray seeds thick and short, triangular, acute.—Camp Goodwin, Gila Valley, Arizona, Rothrock (339), 1874. Apparently a common plant in the sandy valleys of the Rio Grande (Wright, Brandegee) and Gila, but very rarely collected. Dr. Rothrock's specimens have a ligneous, very stout, tapering root 3″ in diameter, with many stems (1–1½″ thick) from the neck, just as we sometimes see other annual Anisophylla, *E. hypericifolia* among them, so that they simulate and actually become perennials; real perennials, however, such as the next species, have cylindric or tuberous roots, usually with slender and even filiform bases to the stems, which are buried beneath the surface. The slender leaves and the short, leafy, alternate flowering branchlets, much shorter than the internodes of the elongated stems, characterize this species at once. Like the Californian *E. ocellata*, it is distinguished by large cup-shaped glands, usually less than four in number, and scarcely or not at all margined.

Euphorbia (Anisopyhllum) Fendleri, Torr. & Gray, Pacif. R. R. Rep. 2, 175; Bot. Mex. Bound. 186; Boiss. *l. c.* 38; *E. rupicola*, Scheele, not Boiss.—Glabrous; many suberect or ascending, short, rigid stems of a finger's length from a perennial root; thick leaves, obliquely triangular-ovate to lanceolate, 1–2½″ long, entire, often reddish; stipules subulate or somewhat lanceolate; involucres in terminal and lateral leafy cymules;

glands with narrow or with longer, sometimes triangular, entire or dentate or lobed, greenish or reddish appendages, or without any; seeds quadrangular-oblong, undulate and scrobiculate.—Santa Fé, Rothrock (13), 1874; number 1003 is the same from Arizona. Not rare from Western Texas, through New Mexico and Southern Colorado to Arizona. A diminutive, suberect bush of many stems and branches, very variable in the width of its leaves, but readily recognized by the characters enumerated.

Euphorbia (Anisophyllum) polycarpa, Benth. Bot. Sulph. 50; Bot. Mex. Bound. 186; Boiss. *l. c.* 44.—A perennial, often flowering in the first year as an annual, prostrate or erectish, glabrous, sometimes pubescent (or even tomentose in a variety), with orbicular-cordate or oblong entire leaves, always with linear, delicately ciliate stipules; involucres axillary, rarely crowded into few-flowered cymes; appendages of the dark red (or, when dry, black) glands large and conspicuous, or smaller; seeds gray-reddish, linear-oblong, quadrangular, smooth or slightly undulate. The typical, large-flowered, glabrous form is found principally along the Pacific coast from Cape St. Lucas to the southern part of the State of California; inland, and especially in the California Desert and up the Gila, where Dr. Rothrock collected it in 1874, a larger, wide-spreading, very much ramified form is found, with smaller, glabrous or pubescent, oblong or oblong-linear leaves $\frac{1}{2}$–$1\frac{1}{2}''$ long, with smaller involucres, very small, almost or entirely inappendiculate glands, and very short styles, but seeds of the same size and form as in the type. The stipules of all forms are alike, linear, entire, minutely ciliate. *E. micromera*, Boiss. *l. c.* 44, seems identical with this last form, and we will have to consider *E. melanadenia*, Torr. Pacif. R. R. Rep. 4, 135, as a tomentose variety, as suggested by S. Watson; an intermediate form is *E. cinerascens*, Engelm. Bot. Mex. Bound. 186.

Euphorbia (Anisophyllum) serpyllifolia, Pers. Ench. 2, 14; Boiss. *l. c.* 43; Gray, Man. 432; *E. inæquilatera*, Engelm. Bot. Mex. Bound. 187; not Sonder.—Zuñi, Rothrock, 1874 (173). An extremely variable species, but readily recognized by its glabrous, obovate leaves, acute at the unequal base, broader and serrulate at the rounded tip; stipules setaceously divided; involucres in lateral leafy clusters; seeds gray, linear, acutely 4-angled, slightly wrinkled or pitted. The closely allied *E. glyptosperma*, Engelm.,

may always be distinguished by the broad semicordate base of the leaves, the lower half of which is protracted and almost auriculate, and by the sharply cross-ribbed and at the angles, notched seeds. The form collected at Zuñi is suberect, nearly a span high, with leaves more sharply serrate than usual, and more distinctly rugose.

EUPHORBIA (ANISOPHYLLUM) PEDICULIFERA, Engelm. Bot. Mex. Bound. 186; Boiss. *l. c.* 48.—Plant, pale dull green, covered with a short, scanty pubescence; many prostrate stems from a perennial root, a span to a foot long; leaves rather large (6″ long or more), oblique, oblong, obtuse, entire; small stipules triangular-subulate; involucres in few-flowered, lateral, leafy cymes; glands with broad, dentate appendages; capsules canescent; seeds oblong, angular, strongly marked with 4 deep transverse grooves, deeply notched on the edges.—Cienega, near Tucson, Ariz., Rothrock, 1874 (576). A native of our extreme Southwest, from Arizona to Southern California and into adjoining Mexico; well marked by its larger, dull grayish-green leaves, and especially by the (for the section) large, deeply grooved and notched seeds, which curiously simulate some insect.

EUPHORBIA (ANISOPHYLLUM) HYPERICIFOLIA, Linn.; Bot. Mex. Bound. 188; Gray, Man. 432.—Two forms were collected by Dr. Rothrock in 1874. The common form (672) from Camp Crittenden, Southern Arizona, is that of the States, called *E. Preslii*, Guss., Boiss. *l. c.* 22, glabrous, with rather small, blackish, much cross-wrinkled seeds The other form (720), from Camp Lowell, Southern Arizona, has seeds larger than the last, in size between those of *E. Brasiliensis*, Lam., and the large-seeded *E. Bahiensis*, Boiss., and in form similar to them; all of these have thick, short, almost ovate-cubic, black seeds, with few prominent tubercles arranged in about 2 interrupted transverse ridges. Our plant is nearly glabrous; leaves very pale below, with long, sparse ciliæ on the upper edge near the base.—The different species allied to *E. hypericifolia* require further study, as it is a mooted question whether the pubescence of the plant and even that of the capsules, and the size, the color, and the markings of the seed, constitute here specific differences. If they do not, then we have here one of the most polymorphous species, spread over all the warmer countries of the

globe, and most difficult to define by floral and carpological, but easily recognized by the vegetative characters.

EUPHORBIA (POINSETTIA) CUPHOSPERMA, Boiss. *l. c.* 73; *E. dentata*, var. *cuphosperma*, Engelm. Bot. Mex. Bound. 190.—A slender, erect annual, 1–1½° high, simple or with few erect branches, nearly glabrous, with few bristly hairs; leaves lance-linear, 1–2′ long, upper involucral ones longer and a little wider, but scarcely discolored at base, all entire or with a few teeth on the revolute, scabrous margins; the large involucres in loose clusters, deeply campanulate, with 1 or 2, rarely more, slender, almost tubular glands; seeds short and thick, triangular, truncate at base, cross-ridged and tuberculate, with a minute caruncle.—Cienega (Creek), Arizona, near Tucson, Rothrock, 1874 (577).

A rare plant, found only once before, by Wright, mistaken by me for a form of *E. dentata*, but well distinguished from that species (which extends far into Mexico) by its involucres and seeds. *E. dentata* has much smaller turbinate involucres, with broad glands, and smaller ovate or subglobose, minutely tuberculated seeds.

EUPHORBIA (TITHYMALUS) DICTYOSPERMA, Fisch. & Mey.; Boiss. *l. c.* 135; Gray, Man. 434.—Camp Grant, Arizona, Rothrock (370), 1874.

EUPHORBIA (TITHYMALUS) CAMPESTRIS, Cham. & Schlecht, Linn. 1830, 84; Boiss. *l. c.* 146; *E. esulæformis*, Schauer, Linn. 1847, 729; Bot. Mex. Bound. 192.—Several erect stems, 1–1½° high, from a stout perennial root; glabrous leaves linear-lanceolate; lower branches sterile with narrower leaves, upper ones flower-bearing; terminal umbel 5-rayed; exterior floral leaves ovate-lanceolate, interior ones shorter, but all longer than wide; involucres turbinate-campanulate, on pedicels of nearly their own length; glands semilunate, with short horns; styles longer than the ovary, united at base, bifid upward; seeds ovate, gray, marked with irregular, shallow, dark impressions.

Willow Spring, Arizona, Rothrock, 1874 (213); and southward and southwestward throughout Mexico.—The narrow leaves, especially on the sterile branches, and the narrow floral leaves, distinguish this species from its allies in the Southwest, and approach it, in habit at least, to the European *E. Esula*.

SAURUREÆ.

ANEMOPSIS CALIFORNICA, Hook.—New Mexico, Arizona, and Nevada (554, 88). This is the Yerba de Mansa of the Mexican population.

JUGLANDEÆ.

JUGLANS CALIFORNICA, Watson (Proc. Amer. Acad. x, p. 349).—Floccose-tomentose or glabrous; leaflets 5–8 pairs, oblong-lanceolate, usually tapering upward to a point, somewhat falcate, obscurely crenate-serrate, 2–3′ long; "male aments 4–8′ long, often in pairs; sepals acute or obtuse, veined, $1\frac{1}{2}''$ long; stamens 30–40, the anthers a line long, with the apex of the connective very short and bifid; fruit globose, slightly compressed, $\frac{3}{4}$–1′ in diameter: nut shallowly sulcate, the walls rather thin and with two broad cavities upon each side (*J. rupestris*, var. *major*, Torr. in Sitgreaves's Report, p. 171, t. 16)." From the imperfect character of my own material, I have had to quote the above largely from Mr. Watson's description. Tree 20 feet high, and bark somewhat resembling that of the White Walnut.—Southern Arizona, at 5,500 feet (No. 276).

CUPULIFERÆ.

BY DR. GEORGE ENGELMANN.

QUERCUS UNDULATA, Torr. Ann. Lyc. N. Y. 2, p. 248, t. 4; Engelm. in Trans. St. Louis Acad. 3, 382, 392.—A scrubby White Oak of the Rocky Mountains and through Arizona, with annual maturation, very variable in foliage, and to some extent also in stature and habit; leaves from 3–4′ to 1′ or less in length, bluntly lobed or even pinnatifid to spinous-dentate or entire, deciduous to persistent, always downy below, at last glabrate above; anthers 6–8, small, glabrous; stigmas sessile or on short styles; acorns subsessile, or on shorter or longer peduncles; cups deep, scales generally tumid, nut oblong, sometimes elongated, sweet.

Var. GAMBELII, Engelm. *l. c.*; *Q. Gambelii*, Nutt.—A bush or small tree, with larger, bluntly lobed (lobes often retuse or notched), dark green, deciduous leaves, and commonly larger elliptic nuts, in deep, strongly tuberculated cups.—Collected by the different Expeditions over the whole

territory. A tree 20–30 feet high, at Willow Spring, Arizona, at an altitude of 7,500 feet, Rothrock (252), 1874.

Var. PUNGENS, Engelm. *l. c.; Q. pungens*, Liebm.—Shrubby, leaves much smaller, often only 1′ long, of paler color and rigid coriaceous texture, spiny-dentate, often somewhat persistent; acorns smaller, mostly elongated, with tomentose, scaly, usually less knobby cups. Collected throughout Arizona by the different Expeditions.

Var. OBLONGATA; *Q. oblongifolia*, Torr. Bot. Mex. Bound 206, not Bot. Sitgr.—Shrub or small tree with small (1–1½′ long), oblong, more or less entire, pale, coriaceous leaves, smooth and shining above, scarcely reticulate below; acorns long-peduncled.—On the Mesa south of Black River, Arizona, and in Rocky Cañon, Arizona, Rothrock (292), 1874. A form of this, var. *grandifolia*, Engelm. *l. c.*, with leaves 3–5′ long, and peduncles 2–3′ in length, occurs occasionally from Southern Colorado to Arizona.

Var. GRISEA, Engelm. *l.c.; Q. grisea*, Liebm.—With similar-shaped, entire or irregularly dentate, very thick leaves, often cordate at base, below strongly reticulate, and, like the branchlets, yellowish pubescent, with larger, subsessile or short-peduncled acorns. A bush or small tree, 20° high.—Camp Apache, Dr. Girard, G. K. Gilbert, and at Camp Bowie, Rothrock (508), 1874. This form evidently connects with the next species.

QUERCUS RETICULATA, H. B K.—A shrubby White Oak, with coarse, persistent, short-petioled, obovate leaves, cordate at base, broader and obtuse above, repandly spinous-dentate, strongly reticulate, and below, together with the branchlets, fulvous-tomentose, sparsely stellate-hairy above; fruit-peduncles about half as long as the leaves or shorter, bearing one to several acorns in deep, strongly tuberculate cups.—On Mount Graham, Arizona, at 9,500 feet altitude, Rothrock, 1874 (759). A shrub, 2–4 feet high, with leaves 2′ long and 1½′ wide. It agrees perfectly with the Mexican forms, which, however, seem to make large trees, often with larger leaves; the leaves of the previous year are found to be persistent even as late as September.

QUERCUS EMORYI, Torrey, Bot. Emory's Exped 1848, 151, t. 9, not of Bot. Mex. Bound.; Engelm. *l. c.* 382 and 394; *Quercus hastata*, Liebm.—A shrubby or arborescent Black Oak, with rough, black bark, and dark-green

foliage, downy when young, glossy and almost glabrous when old, and persistent until the new leaves have come out; branchlets downy; leaves coriaceous, 1½–2½′ long, 5–9″ wide, on very short, downy petioles, lanceolate with a cordate or (by the two lowest teeth spreading) hastate base, tapering to a sharp point, repandly spinous-dentate or rarely entire; staminate flowers with 4–5 large anthers, pistillate ones with long, recurved styles; sessile fruit maturing in the first year; cup hemispherical, with brown, triangular, obtuse, almost flat scales, and covering about ⅓ of the oblong, long-pointed nut.—Rocky Cañon, Arizona, Rothrock, 1874 (287). Extends through Arizona and New Mexico to Western Texas. Botanically a most interesting species, as it combines many characters of the White Oaks, viz., the annual maturation and especially the position of the abortive ovules at the base of the nut, with characters of the Black Oaks, viz., the black bark and coarse wood, the small number and large size of the stamens, the long, recurved styles, and the tomentose inner coating of the shell; the leaves show, as they do in many Black Oaks, a stronger reticulation on the upper than on the lower side.

Quercus hypoleuca, Engelm. *l. c.* p. 384; *Q. confertifolia*, Torr. Bot. Mex. Bound. 207, not H. B. K.—An evergreen Black Oak, with annual maturation of fruit, forming a middle-sized tree, with dark, rough bark; leaves coriaceous, lanceolate or oblong-lanceolate, tapering into a short petiole, 2–3½′ long, ½–1′ wide, revolute on the margin, entire or with a few broad teeth toward the tip, glabrous and shining above, white-tomentose, with smoother and darker ribs below; 4 glabrous anthers in the 5-lobed calyx; styles recurved; acorns sessile or short-peduncled; cup-scales ovate-triangular, obtuse, bright brown.—Sanoita Valley, Southern Arizona, at 7,000 feet altitude, Rothrock, 1874 (653); also found on the San Francisco Mountains. A very conspicuous and as yet little known species, which Dr. Rothrock found 30 feet high and 1 foot in diameter.

LORANTHACEÆ.

By Dr. George Engelmann.

Phoradendron flavescens, Nutt.—The collection contains a number of specimens, which represent two distinct forms, different from the com-

mon Eastern type. The first may be characterized as var. *macrophyllum*, with large orbicular-obovate, glabrate leaves, only in the young state with an evanescent pubescence, $1\frac{1}{2}$–$2\frac{1}{2}'$ long, 3- and often 5-nerved; staminate spikes unusually thick, with 4 or 5 short joints, each with 10–40, comparatively large, pubescent flowers.—They grow on soft woods (Ash, Willow, Poplar, Sycamore, and Sapindus) on the Gila and Bonita Rivers, and extend into Southern California, G. K. Gilbert, Dr. Rothrock.

Var. VILLOSUM (*Phor. villosum*, Nutt.), with woolly, obovate, and var. ORBICULATUM, with rounded, pubescent leaves, are found on hard woods, principally on Oaks, in Oregon, California, Arizona, and southeastward. On the mountains about Camp Apache, Arizona, they grow on different varieties of *Quercus undulata*.

PHORADENDRON CALIFORNICUM, Nutt. Pl. Gambel. p. 185.—Slender, terete, much branched, leafless stems, 1–2° long, bearing, in the axils of the opposite, connate, acute, spreading scales, numerous short, pubescent, 1- or few-jointed spikes, each joint with 2–6 flowers; staminate flowers with oblong anthers, the cells opening longitudinally.—Arizona and Southern California, G. K. Gilbert, Dr. Rothrock, on *Mimoseæ*, *Larrea*, and a few other shrubs.

PHORADENDRON JUNIPERINUM, Engelm. Pl. Fendl. p. 58.—Half a foot to a span high, densely branched; small, obtusish leaf-scales ciliate; staminate spikes very short, mostly with a single 6–8-flowered joint, pistillate ones with only two opposite flowers.—Common on different species of Juniper throughout Arizona and in the adjacent districts; collected by all the different Expeditions. The short joints are so fragile that the dried specimens easily break up.

ARCEUTHOBIUM* AMERICANUM, Nutt.; Engelm. Pl. Lindh. 214.—Slender, dichotomously and verticillately much branched, greenish-yellow; staminate

* ARCEUTHOBIUM, Bieb.—Flowers diœcious, axillary and terminal, single or several from the same axil; staminate flowers mostly 3- (rarely 2-, 4-, or 5-) parted; the axillary buds compressed, the terminal ones globose; circular anthers aduate to the lobes, 1-celled, after opening saucer-shaped; pollen-grains spinulose; pistillate flowers compressed, ovate, subsessile; pedicel at length elongated, and at maturity recurved; berry compressed, fleshy, dehiscent at the circumscissile base. Glabrous, jointed, shrubby parasites of Conifers, of greenish or brownish color, with quadrangular branches and scale-like leaves connate into sheathing cups; flowers often crowded into apparent spikes or panicles, opening in spring, summer, or autumn; berries mature in the second autumn, when they suddenly and forcibly eject the glutinous seeds to the distance of several yards.

plants, 2–4′ high, ¼–1″ thick at base; fertile plants much smaller; flowers small, staminate ones 1″ wide, lobes ovate-orbicular, acutish; pistillate flowers ½–1″, fruit 2″ long.—Only on *Pinus contorta*, Rocky Mountains to Oregon and California; near Breckenridge, at 10,000 feet altitude, Wolf, 1873. Flowers late in autumn.—In this and the next species, accessory flowers or flowering branchlets are developed on the fruiting specimens, in this lateral, in the next dorsal to the fruits or fruiting branches. In these two we find no other secondary formation on the fertile plants, but in the other species sterile branchlets are developed on them which would flower in the following year; thus these latter continue their existence for a longer time than the two first ones.

ARCEUTHOBIUM DOUGLASII, Engelm. ined.—Slender, small, ¼–1′ high, greenish-yellow, dichotomously branched; branches suberect, single or with accessory ones behind the first; flowers in short, usually 5-flowered, spikes, staminate ones less than 1″ wide, with orbicular-ovate acutish lobes; fruit 2½″ long.—On *Pseudotsuga Douglasii* from New Mexico (on Santa Fé River, Rothrock, No. 69, 1874) to Utah, Parry, Siler, and Northern Arizona, Camp Apache, G. K. Gilbert (109), 1873.—Flowers May–June.—Similar to the last, but smaller, and never with verticillate branchlets or flowers, which are so common in that species The thallus-like tissue or stroma, which creeps along within the bark of the nurse plant, buds out in autumn all along the three years old shoot; after about 12 months, the flower-buds are formed, to open in the following spring, after which the life of the male plant is exhausted; but it takes another year to perfect the fruit. The female parasite, now fully three years old, generally dies, but sometimes lives and fructifies another season. The Northeastern *A. pusillum*, Peck, behaves in the same manner, while in *A. Americanum* and some other species the buds of the parasite make their appearance at first only among the older bud-scales of the pine branch.

Var. ? MICROCARPUM is parasitic on *Picea Engelmanni*, found by Mr. Gilbert in 1873 (100 and 102) in the Sierra Blanca, Arizona; it is a little taller, 1–2′ high, but has much smaller fruit, only 1¾″ long, the smallest of any American species.

ARCEUTHOBIUM DIVARICATUM, Engelm. ined. *A. campylopodum*, var.

Engelm. Pl. Lindh. 114.—Much stouter than the last, 2–4′ high, below 1″ in diameter, olive-green or light brownish; branches spreading, often recurved; staminate flowers few and scattered, or in 3–7-flowered spikes, 1″ in diameter, with ovate, acute lobes; inflorescence often bearing sterile branches from the same axils as the fruiting ones and behind them; fruit $1\frac{1}{2}$–$1\frac{3}{4}$″ long.

On Nut-pines (*P. edulis* and *monophyllos*) from Southern Colorado through New Mexico to Arizona, G. K. Gilbert, 1873 (116), Dr. J. B. Girard, 1874. Flowers August and September. Intermediate in size and color between the last and the following; well marked by its divaricate habit and its scanty flowers.

ARCEUTHOBIUM ROBUSTUM, Engelm. Pl. Fendl. p. 59; *A. cryptopodum*, Engelm. Pl. Lindh. p. 214.—Stout, 2–4′ high, 2–3″ thick at base, paniculate, much branched, brownish-yellow to dark olive-brown; staminate plants smaller than the pistillate ones; staminate spikes with much-compressed, adpressed buds; flowers mostly 3-parted, $1\frac{1}{4}$–$1\frac{1}{2}$″ wide; anthers attached above the middle of the ovate, acute lobes; ripe fruit $2\frac{1}{3}$″ long.

Only on *Pinus ponderosa*, Colorado, New Mexico, and Arizona; Camp Apache (G. K. Gilbert, 1873) and Mount Graham (Rothrock, 787), 1874. Flowers in June. Fruit mature in August and September. The closely allied *A. occidentale*, Engelm., is distinguished by more elongated spikes, ventricose, divaricate buds of the staminate, mostly 4-parted, larger flowers, with lanceolate, acuminate lobes and anthers attached below their centre; it also occurs on *Pinus ponderosa*, but more frequently on other Conifers. Both persist for several years, the female plants always longer than the male.

SANTALACEÆ.

COMANDRA PALLIDA, var. ANGUSTIFOLIA, Alph. DC.—Rocky Cañon, Arizona (273).

COMANDRA UMBELLATA, Nutt.—Nevada.

CONIFERÆ.

By Dr. George Engelmann.

Abies* subalpina, Engelm. Am. Nat. 1876, p. 554; Trans. Ac. St. Louis, 3, 597; *Abies grandis* in part, of the Rocky Mountain botanists.—A large tree, 60–80° high, with very pale and thin, smooth, or, only in very old trees, cracked, and ashy-gray bark; leaves ¾–1′ long, dark green above, paler or whitish underneath, on the lower branches flat, grooved above, notched at tip and distichous, those of fertile or of erect shoots all around the axis, sharp-pointed and convex and often with stomata above; cones cylindrical-oblong, retuse, 2½–3′ or 3½′ long, 1–1⅓′ thick, of purplish-brown color; bracts broadly oval, denticulate, mucronate, much shorter than the nearly orbicular or sometimes somewhat quadrangular scale; purplish wings of seeds nearly twice longer than wide; cotyledons 4–5.

Colorado to Utah on the higher mountains and near to the timber-line; extending north and northwestwardly. A poor, soft, almost spongy timber, with paler bark than any other American species. The resin ducts of the leaves are imbedded in the parenchyma, about equidistant from the upper and the lower surface.

Abies concolor, Lindley; Engelm. Trans. *l. c.* 600.—A large tree, 80–150° high, with ash-colored, at last thick and much cracked bark, with longer and broader leaves than the last (in young trees often 2–3′ long, shorter in old ones), 2-ranked, and when young glaucous, later pale dull green, with stomata on both sides; leaves on the upper branches obtuse, convex above, often falcate; cones cylindrical-oblong, obtuse, 3–4′ or even 5′ long, 1½–1¾′ thick, mostly apple-green, sometimes purplish-gray; bracts orbicular-ovate, mostly mucronate, much shorter than the very

* Abies, Link, not Don; *Abies* sect. (Firs), Gray's Man.; *Pinus* sect. *Abies*, Endl. Parlat.; *Picea*, Don.—Coniferous trees with more or less flattened, and on the sterile branchlets, by a twist near their bases, two-ranked, sessile, persistent leaves, which eventually leave on the branches circular, flat scars; flowering from the axils of the leaves of the previous year; staminate flowers (usually called staminate aments) in the form of an oval or cylindrical ament; anthers without crests, bursting transversely with large (0.11–0.14^{mm} in the larger diameter) 2-lobed pollen-grains; cones erect on the more or less horizontal branchlets, maturing in one season; their scales with their enclosed or exsert membranaceous bracts falling from the persistent axis; seeds covered with balsam-receptacles, and partially but permanently enclosed in the pergamentaceous base of the wing, which covers the outer and laps over the inner surface.—Stately trees of rapid growth, but with brittle and rapidly decaying wood.

broad, transversely dilated scale; wings of seeds pale, very oblique, as long as wide; cotyledons 5–7, usually 6.

Common on the mountains of New Mexico and Arizona. Thence extending through Southern Colorado and Utah and throughout the California Sierras. A tree of beautiful foliage, highly prized in cultivation; furnishing better timber than the last, from which (besides the characters already enumerated) it can always readily be distinguished by the two resin-ducts of its leaves lying close to the epidermis of the under surface. In Colorado as well as in California it has often been named *A. grandis*, a species which properly belongs to the coast regions of Oregon, the Lower Columbia River, Vancouver Island, etc.

PICEA* ENGELMANNI, Engelm.; *Abies Engelmanni*, Parry; *Pinus commutata*, Parlat.—Large trees, 60–100° high, with thin, cinnamon-brown, scaly bark; branchlets mostly pubescent; leaves 4-sided, slender and acute or acuminate in younger, and shorter, stouter, short-pointed, and curved in older trees (especially in higher altitudes), with stomata on both sides; cones oval or oblong, about 2″ long, paler or purplish, falling off at maturity; scales thin, erose-denticulate, broad, with a rounded edge or usually somewhat prolonged upward and truncate; seeds half as long as the very oblique wing, usually with 6 cotyledons.

San Francisco Mountains, Bischoff; Sierra Blanca, Gilbert; Mount Graham, Rothrock (784). The most southern localities known of this northern and sub-alphine species, which extends through the Rocky Mountains to British Columbia and to Oregon, forming extensive forests. A beautiful tree, often 2° and even 3° in diameter; timber similar to that of *P. nigra* of the Northeast and *P. excelsa* of Europe: above timber-line, it dwarfs down to mere shrubs, often prostrate, but loaded with cones.

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* PICEA, Link, not Don; *Abies*, Don; *Abies* sect. (Spruces), Gray's Man.; *Pinus* sect. *Picea*, Endl., Parlat.—Coniferous trees with single evergreen, more or less 4-sided leaves, which at last separate from a prominent, persistent, ligneous base; flowering from the axils of the leaves of the previous year; staminate flowers as in *Abies*, but stamens tipped with a large, nearly orbicular, denticulate crest; cells opening longitudinally; pollen as in *Abies*, 0.09–0.13^{mm} in longer diameter; cones pendulous from the ends of short or elongated branchlets, maturing in one season; scales and small enclosed membranaceous bracts persistent on the axis; seeds without balsam-vesicles, imbedded in the excavation of the membranaceous base of the wing, which leaves their under side nearly free and permits them to drop out.—Trees of slower growth than the firs, with white, soft, but tough, close, and highly esteemed timber.

PSEUDOTSUGA* DOUGLASII, Carrière; *Abies Douglasii*, Lindl.—Often one of the tallest trees known (in favorable localities, in Oregon, even 300–350 feet high), with very thick, much cracked, brown bark, spreading branches, conspicuous, somewhat persistent bud-scales, slender, flat, linear, obtuse or acutish leaves, $\frac{3}{4}$–$1\frac{1}{4}$, rarely $1\frac{1}{2}$ inches long; cones ovate-oblong, usually 2–3′ long, brown, well marked by the protruding, long-cuspidate bracts; scales orbicular, concave; oval wings about as long as the somewhat triangular, pale seeds; cotyledons 6–8.

Common through Arizona, as it is through all the western mountain regions, down into Mexico.—Leaves stomatose and whitish only on the lower surface, with 2 resin-ducts close to the epidermis of the under side.

PINUS† FLEXILIS, James; Parlat. in DC. Prod. 16, 2, 403.—A middle-sized tree, with a smoothish, or, in old trees, lightly furrowed, pale or ash-gray bark; leaves in fives, mostly entire and smooth-edged, $1\frac{1}{4}$–2′ long, in a loose, deciduous sheath, about $\frac{1}{2}$′ in length; involucre of the oval staminate flowers composed of 8–9 oval, obtuse scales; anthers with a short lacerate or toothed crest; cones sub-terminal,‡ spreading, or slightly reflexed, ovate-cylindrical,

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* PSEUDOTSUGA, Carr. Conif. ed. 2, 256; *Abies*, sect. *Tsuga* (in part), Endl.—Coniferous trees, with flattened, entire, somewhat 2-ranked, distinctly petioled leaves, leaving on the branchlets scarcely prominent, transversely oval scars; flowering from the axils of the leaves of the previous year; staminate flowers resembling an oval or subcylindrical ament; anthers with a recurved, spurlike point; cells opening longitudinally; pollen oval-subglobose; sessile cones subpendulous, maturing in one season; scales and their much elongated bracts persistent on their axis; seeds without balsam-vesicles, not separating from the wing.—Very large trees, with very thick bark and reddish or yellowish wood, of secondary value, which is characterized and well distinguished from the wood of all the allied genera, and of most coniferous woods, by the abundance of spiral vessels, otherwise so rare in this family. The difference in the pollen, the seeds, and the leaf structure make a separation of this genus from *Abies* as well as from *Tsuga* necessary.

† To the character of the genus *Pinus* may be added: Staminate flowers surrounded by an involucrum, of a somewhat definite number of scales (3–15 or 20), the lowest, lateral, pair of which are strongly keeled; pollen-grains lobed, similar to that of *Abies* and *Picea*, but only half as large, 0.04–0.06^{mm} wide. The bracts of the cones, which, in the allied genera, remain membranaceous, become here much thickened and corky, and, together with the scale below them, form a sort of cell for the reception of the seeds. The base of the wing only partially covers the upper side of the seed, and usually forms a mere rim around the seed, which easily separates from it; in a few species, the wing is firmly attached to the seed, and in a few others it is reduced to a narrow margin; the seed never shows balsam-vesicles.

‡ The fertile aments of *Pinus*, and consequently the cones, are usually called *terminal*, but they never are that, but always *lateral*, and either appear between the uppermost leaves and the terminal bud, when they may be called sub-terminal (*P. resinosa*, *Strobus*, *sylvestris*), or the axis continues to elongate after the formation of the aments, when these and consequently the cones become *lateral*, the axis bearing leaves and sometimes other aments above them (*P. Tæda*, and especially *inops*, and in Europe, *P. Halepensis*). In some species both forms occur, or only a few leaf-bundles intervene between

3–4½′ long, squarrose by the more or less protruding thin-edged scales, the free part of which is rounded or more or less triangular, rarely reflexed; seeds 5 or 6″ long, somewhat angled, with a narrow deciduous wing-rim; cotyledons 6–7.

Var. *α*. SERRULATA.—Leaves slender, slightly and distantly serrulate, and as in the two following varieties, with few or scarcely any stomata on the back; cones of the ordinary form.

Var. *β*. MACROCARPA.—Leaves slender, entire; cones cylindric, 6–8′ long, 2½′ in diameter, the apophysis of the scales short, rounded.

Var. *γ*. REFLEXA.—Leaves as in last; cones ovate-cylindrical, about 4′ long; apophysis elongated, reflexed.

A middle-sized tree, rarely more than 50 feet high, on the higher mountains of Colorado, New Mexico, and Arizona, extending to Southern California. Var. *α* was found by Dr. Rothrock on Mount Graham (783); var. *γ*, by the same, on Santa Rita Mountain (east of Tucson) and in the Sanoita Valley (654 and 1001). The cone of 1001 resembles that of the Asiatic *P. Koraiensis*, or of a small *P. Ayacahuite* from Mexico. Var. *β* was collected on the San Francisco Mountains by Mr. Ferdinand Bischoff in 1871.—The species is intermediate between the true *Strobi* and *Cembra;* of the former it has the peripheral resin-ducts, usually 2, on the dorsal side; with the latter it has the large, almost wingless seeds in common; from both it is distinguished by the back of the leaf being marked by a single, or a few series of stomata. It thus becomes the type of a third section of the *Strobus*-like Pines, which may be arranged as follows:

1. *Cembræ*, with large, almost wingless seeds; dorsal face of leaves without stomata; resin-ducts of the serrulate leaves imbedded in the parenchyma; *P. Cembra* of Europe and Asia with appressed, and *P. Koraiensis* of Northeastern Asia with squarrose cone-scales. 2. *Flexiles*, with similar seeds, but entire or nearly entire leaves, with a few series of stomata on back, with peripheral ducts; *P. flexilis*, *P. albicaulis*, and the Asiatic *P. pygmæa*. This last is thus entirely distinct from *P. Cembra*, as a variety of which it has long been considered by Parlatore and other botanists, while *P. Mandschurica*, at least

the aments and the terminal bud. When, in the following season, the axis elongates, while the ament matures to a cone, this latter naturally becomes quite lateral, but we continue to designate it as subterminal, in relation to its own, coëtaneous, part of the axis.

what I have seen under that name, is a true *Cembra*, not to be thrown together with *P. pygmæa*, as has been done, and distinguished from *Cembra* itself by the denticulate *Strobus*-like leaf-tips. 3. *Eustrobi*, with distinctly winged seeds, leaves sharply serrulate on the edges and generally denticulate all over the tip, mostly without stomata on the back, and with peripheral ducts, like the last. Of this subsection we have *P. Strobus*, *monticola*, and *Lambertiana;* Mexico has *P. Ayacahuite;* Japan, *P. parviflora;* the East Indies and Turkey, *P. excelsa* with *P. Peuce.*

Pinus monophyllos, Torr. & Frem. Report Expl. Exped. 1842–1844, p. 319, t. 4; Parlat. *l. c.* 378.—A small tree, of scraggy growth, with gray bark and stout, mostly single,* terete leaves (rarely in pairs, and then semicylindrical and entire on the margins), 1½–2′ long, ½–1″ thick or wide, with a deciduous sheath; involucre of the staminate flowers of about 6 scales; anthers with a short, entire or denticulate knob; cones subterminal, ovate-subglobose, 2 or 2½′ long and nearly as thick, consisting of few large scales with thick pyramidal apophyses, but without prickles; oval seeds about ½′ long, with a wing nearly 1″ wide; cotyledons 7–10.

The oft-described Nut-pine of Fremont's first expeditions, 35 years ago, common from Arizona to Utah and California. This and the following species furnish an important article of food to the Indians and other natives. That single leaf, before its nature was properly understood, troubled botanists a good deal, so that Endlicher, supposing that the single leaf consisted of two agglutinated ones, went so far as to change the name into *P. Fremontii.* They are really single leaves, and the only instance of such leaves in the genus (I do not speak of the primary leaves of seedlings or young shoots, but only of the secondary leaves, which grow in bundles on what we must take for reduced branchlets).

* The fresh leaves of pines, when single, are terete, and when dry, become grooved and ridged; the leaves which grow in pairs are semiterete, flat on the upper or inner, and convex on the lower or outer side, and only when (on the tree as well as still more in the herbarium) they become dry, they assume that channelled form which we find so often described as characteristic of a species; those leaves that grow in bundles of 3 or 5 are convex on the dorsal and ridged on the upper side; those with 3 are flattish, about half as thick as wide; those with 5 are triangular and nearly as thick as wide. It is therefore superfluous to minutely describe the form of the leaves, as that is already given when the number within the sheath is stated, nor is it proper to describe the dried and shrivelled condition. The serratures, their closeness, the size of the minute teeth or their absence (only in a few Western American species the edges of the leaves are without teeth) are of much greater importance, and to some extent the nature of the tip is also of value.

PINUS EDULIS, Engelm. in Wisliz. Mem. note 2.—Similar to the last, but with more slender, entire leaves, mostly in pairs, rarely in threes; staminate flowers surrounded by a 4-leaved involucre; anthers with a knob or short spur; cones and seeds similar to those of the last species, only a little smaller; cones usually but $1\frac{1}{2}'$ long; cotyledons as in previous species.

Camp Bowie, Arizona, Rothrock (493). Common from Southern Colorado through New Mexico to Arizona. The two species here described, together with the slender and 3-leaved *P. cembroides*, with harder shells to the larger seeds, and 8–12 cotyledons, and the little-known 4–5-leaved *P. Parryana* of the northern part of Lower California, constitute a small group of very peculiar Pines, which we may designate as the Cembroid Pines, characterized by the leaves of the *flexilis* group (with entire margins, peripheral ducts, and deciduous sheaths), by the seeds of *Cembra* and by the cones and scales of *Pinaster*. Perhaps it would be proper not to lay too much stress on the number of leaves and minor characters, nor on their geographical difference, and to unite them under the oldest and most appropriate name of *P. cembroides*, Zucc., though systematists, counting the leaves, have separated them widely in their books.

There is no pine entirely analogous to them in the Old World, unless we should refer here the little-known *P. Bungeana*, Zucc.; Murr. Conif. Jap. 18, of Northern China. It has similar, small, subglobose cones, though with less prominent knobs, but armed with recurved prickles; the seeds are smaller, with a very distinct wing, the leaves in threes lose their sheaths as our Nut-pines do, but are serrulate, and have several peripheral ducts, but, singularly enough, also usually a single interior or parenchymatous one, forming thus a link between several groups.

PINUS ARIZONICA, n. sp.—A middle-sized tree, 40° high, 2–3° in diameter; branches squarrose, with persistent bracts; leaves in fives, 5–7′ long, $\frac{1}{2}''$ wide, closely serrulate, in a sheath over 1′ long (when old less than half as long); oval cone $2\frac{3}{4}'$ long, $1\frac{1}{2}'$ thick; scales with a prominent knob, which in the lower ones is recurved, armed with a recurved prickle.

On the Santa Rita Mountains, in Southern Arizona, Rothrock (652), in 1874. "The best lumber of that region, there called yellow pine." This seems to be a meagre account to found a new species upon in a genus

so difficult as *Pinus*, but I find it impossible to unite it with any other of the allied species. It has the cone of *P. ponderosa*, especially of that form figured by Torrey as *P. deflexa*, and, like all forms of that species, it has the peculiarity that the fallen cones, found on the ground, are always imperfect, their lowest part remaining attached to the branch for another season; I do not know of any other pine with this singular character. But we could not well class this 5-leaved pine with the 3-leaved *ponderosa*. On the other hand, the form of the cone and its scales will not permit us to refer it to the Mexican *P. Montezumæ*, though the structure of the leaf is very similar to that of this polymorphous species, which appears to include even *P. Hartwegii*. The three parenchymatous ducts of the leaf and the strengthening cells* within the sheath of the vessels are exactly as we find them in *Montezumæ*, and different from *ponderosa*.

Pinus ponderosa, Dougl. Parlat. *l. c.* 305.—A large tree, with large and spreading head, thick, deeply cracked, red-brown bark, and heavy, resinous, yellowish wood; thick branchlets, rough from leaf-scars and the persistent remnants of bracts; leaves in twos or mostly in threes, 4–8′, in some rare forms 10–12′, long, $\frac{3}{4}''$ wide, with sheaths at first 1′ long, when old withering to 2 or 3″ long; staminate flowers cylindric, with an involucre of 10 or 12 scales, the lowest pair of which is about two-thirds as long as the innermost; anthers with a large sub-orbicular crest; fertile aments subterminal; patulous cones oval or rarely elongated, very variable in size, 2–6′ long; knob of the scales more or less prominent, and in some forms even recurved, bearing a rather stout prickle; seeds black, ridged on the lower side, wing broadest in the middle; cotyledons 6–8, or in the largest seeds as many as 10.

Colorado, New Mexico, and Arizona, extending through the Northern Rocky Mountains and adjacent regions to Oregon and California, mostly in the middle altitudes; the most common and most useful timber of many

* This name has been given to longitudinal cells with very thick walls, destitute of chlorophyll, which are characteristic of most pine-leaves, and by their different disposition aid in distinguishing them from one another. They are generally arranged close to the epidermis, and especially in the angles of the leaves, and have usually about the same diameter as the epidermis-cells themselves. We find them also occasionally surrounding the ducts, *e. g.* in *P. ponderosa*, also in the Cembroid Pines and in *P. Balfouriana* and *P. aristata*; while in *P. flexilis* they always leave the ducts free, a character by which we can readily distinguish the leaves of these species, otherwise so similar. Not rarely are they found within the sheath, strengthening, as it seems, the centre of the leaf.

parts of that district and generally known there as "yellow pine". A most variable tree, several forms of which have received distinct specific appellations, but the specimens collected in these expeditions all appear to belong to the ordinary smaller-leaved and smaller-fruited form. Whenever the macroscopic characters leave any doubt, the microscopic structure of the leaf appears to offer a sure guide. The leaves contain two or three or often more parenchymatous resin-ducts, usually of uncommonly small diameter, always with some, and often surrounded by many, of those strengthening cells of which I have spoken before; the same cells occur within the sheath, above and below the bundles of vessels. I have examined the leaves of 20–30 specimens from the whole range of the species, and have never failed to discover this same structure, which I must therefore consider as characteristic of the species.

PINUS CHIHUAHUANA, Engelm. in Wislizen. Mem. note 26; Parlat. *l. c.* 397.—A middle-sized tree, with ternate, closely serrulate leaves 2½–4′ long; the loose glistening sheaths ½′ long, deciduous after the first season; staminate flowers slender, cylindric, about ½′ long, sometimes interspersed among the foliage; involucre as long as the nearly entire-margined bract, of 8–10 scales, the outer about half as long as the inner ones; anthers with an almost orbicular crest; oval cones sub-terminal, small, 1½′ long; knobs of the scales bearing recurved, deciduous prickles.

Southern Arizona, in Sanoita Valley, at 6,500 feet altitude, Rothrock (649), in 1874; also Wright, and in Western Chihuahua, Wislizenus.—A tree 30–50° high, "with bark resembling yellow pine"; easily distinguished by the characters given, and especially by its deciduous sheaths. All the Strobi and Cembroids have such deciduous sheaths, but among the Pinasters the sheaths are persistent, except in one or two Mexican species, in *P. Bungeana*, above mentioned, and in this species. Leaves strongly and closely serrulate, and with three or often four parenchymatous ducts.

PINUS CONTORTA, Dougl., var LATIFOLIA, Engelm.; *P. Murrayana*, Balf. Oreg. Com. Rep.—A middle-sized tree, sometimes 60–80° high, and 2–4° in diameter, with thin, scaly bark of grayish to red-brown color, and close, white, rather soft wood; leaves in pairs, 1½–2′ or rarely 3′ long and 1″ wide; staminate flowers oblong, 6″ in length, their involucre commonly of

6 scales; crest of the anthers rounded; pistillate aments subterminal, their scales with erect or spreading points; cones oval, usually very oblique, and often curved, reflexed, 1½–2′ long; scales, especially the lower ones, with largely developed pyramidal knobs in the centre, much smaller on the inner side, armed with strong or sometimes slender, awnlike prickles; seeds black, rough, ridged on the lower side; wing widest below the middle; cotyledons usually 5.

Southern Colorado to California, apparently not noticed in Arizona. A valuable timber tree of the northern mountain regions, forming large forests in the higher altitudes of the Rocky and California mountains, reaching into the British Possessions. The original form, discovered by Douglas near the mouth of the Columbia River (*P. Bolanderi*, Parlat.), is a seaside tree, extending up and down the coast, resisting the ocean storms, as does *P. Halepensis* those of the Mediterranean, and protecting the inside vegetation; it is distinguished by its low, scrubby, and often shrubby growth (whence probably the name), and its slender leaves, not more than ½–⅔″ wide; northward, in British Columbia and Alaska, both forms completely run together. The species was formerly confounded with the Eastern *P. inops*, which differs by its lateral, more or less pedunculated cones; it is more closely allied with the Northern *P. Banksiana*, which, however, bears its scarcely prickly or entirely unarmed, mostly lateral, rarely subterminal, cones erect or patulous, never recurved: a very unusual occurrence among pines. The cones of the Rocky Mountain form, and also those of the seaside scrub, are usually persistent for many years, and often remain closed after maturity (serotinous), while in the variety of the Sierras they appear to open on maturity, and to drop before the following season, as Prof. C. S. Sargent observed.

Juniperus Virginiana, Linn.; Engelm. American Junip. in Trans. Ac. St. Louis, 3, 591.—Santa Fé, N. Mex., Rothrock, in 1874 (43). Readily distinguished by its slender branchlets and leaves with entire margins.

Juniperus occidentalis, Hook., var. monosperma, Engelm. Junip. 590.—A small tree or a bush, with fibrous bark, squarrose branches, and obtuse, minutely denticulate leaves in twos and threes; berries globose, blue-black, or sometimes copper-colored, 3–5″ thick, resinous, pulpy; seeds 1 or 2.

Chiricahua Agency, Arizona, Rothrock. A form common from Southern Colorado to New Mexico and westward; distinguished from the original *J. occidentalis* of Oregon and California by its more squarrose growth, thinner branches, and smaller fruit.

JUNIPERUS PACHYPHLŒA, Torr. Bot. Whipp. in Pac. R. R. Rep. 4, 142; Engelm. *l. c.* 589.—A middle-sized tree, with spreading head and thick, fissured bark; branchlets slender; leaves elongated, often resiniferous on the back, with slightly denticulate margins; berries large, glaucous, many-seeded.

An important tree in Western New Mexico (Fort Wingate, Rothrock, number 140, in 1874) and Northern Arizona; readily distinguished from all the other species by its bark, which Dr. Rothrock compares with that of the white oak, and others with the bark of pine.

JUNIPERUS CALIFORNICA, Carr., var. UTAHENSIS, Engelm. Junip. 588.—More slender than the western type, *J. Californica*, with thinner branches and smaller, not so strongly fringed leaves, often in twos; smaller, more globose berries; embryo with 5 cotyledons, as in the species.

Camp Apache, Arizona, Gilbert, Rothrock.

GNETACEÆ.

EPHEDRA ANTISYPHILITICA, C. A. Meyer.—Arizona and New Mexico.

EPHEDRA TRIFURCA, Torr.—Arizona and New Mexico.

ENDOGENS.

ORCHIDEÆ.

MICROSTYLIS MONTANA.—Bulb 1′ in diameter; stem 6′–15′ high, with 2–3 broad sheaths at base; 1–2 oblong-lanceolate, obtuse leaves, tapering below into sheaths; flowers many, sessile in a narrow spike (which is 2–5′ long), yellowish-white, without the ovary 1″ long, each one subtended by an oval bract 1″ long; sepals equal or nearly so, oval, rather obtuse; *lip next the axis*, somewhat triangular-ovate, conspicuously sagittate at base, but obtuse or occasionally notched at apex; lateral petals filiform (usually coiled up), somewhat longer than the sepals; *column very short, tapering to a point, and with a very minute tooth on either side below; stigma a small depres-*

sion or pit; anther nearly sessile, of two parallel cells, open above, and free above from column, pollen masses two, not divided, or with a mere sulcation, attached to the minute gland on the tip of the column; mature capsules 3–4″ long, oval.

It is particulary remarkable in having a dense spike of sessile flowers. Mount Graham, Arizona, at an elevation of 9,500 feet (734). It appears to be extremely rare. I am indebted to Mr. Watson for indicating the genus, and also for the information that the plant was probably undescribed.

Habenaria leucostachys, —?—Stem leafy; leaves oblong-lanceolate, obtuse; spike long, densely flowered; bracts about as long as the flower. My specimen from Willow Spring, Arizona (269), shows a well-marked, hooded, posterior sepal, such as we might expect to find in *H. dilatata*, but is without the dilated base to the lip and the trowel-shaped rostellum of the latter species; lip lanceolate, not longer than the somewhat curved spur. The locality whence this specimen was obtained was a very cold, damp one (even though in Arizona), at an altitude of 7,195 feet.

Habenaria hyperborea, R. Br.—Colorado (965).

Habenaria dilatata, Gray.—Colorado; in company with the above. Quite too near some forms of the above species, as the characters on which the distinctions are founded vary immensely.

Epipactis gigantea, Dougl.—Nevada.

Goodyera Menziesii, Lindl.—Entirely in accord with the figure (*Spiranthes decipiens*, Hook.), 204, Hook. Fl. Bor. Amer., except that on either side of the base of the lip, in some of my specimens, there is a distinctly serrated crest. Other flowers from the same spike have a single crest in the median line.

Mount Graham, Arizona, at 9,500 feet elevation (749).

Spiranthes Romanzoviana, Chamisso.—Mount Graham, Arizona, at 9,500 feet elevation (752); Utah; Colorado.

Corallorhiza Macræi, Gray?—I name this specimen so with great doubt. It will more likely prove to be new, I think. It differs from the genuine *C. Macræi* in its smaller flowers, short, thick column, spur short, thick, and truncate, the lip oval, and with a distinct auricle on either side at base.

Mount Graham, Arizona, at 9,500 feet (750).—This peak appears to

be especially a *rendezvous* of our more northern forms of Orchids. It is not unlikely that the summits of the White Mountains of Arizona still further north would show even a greater number.

IRIDEÆ.

IRIS TOLMIEANA, Herb. Bot. Beechey.—South Park, Colorado, common (967). Dr. Loew also collected an imperfect specimen from further south, probably New Mexico.

SISYRINCHIUM MUCRONATUM, Michx. (*S. Bermudiana*, L., of Preliminary Report, 1874).—Regarded by Mr. Watson as distinguished from *S. Bermudiana*, L, "by its low and usually very slender habit, the scape always terminated by a single spathe sessile within the terminal longer bract, and the flowers small, with segments setosely mucronate and capsules globose" (Proc. Amer. Acad. xii, p. 277). My specimen (945) from Colorado has larger flowers, and is probably somewhat out of range; still I regard it as belonging to this form.

SISYRINCHIUM BELLUM Watson (Proc. Amer. Acad. *l. c.*).—6–18′ high; leaves narrow, smooth, shorter than the smooth stems; terminal bracts 1–3′ long, not longer than the peduncle; spathes 2, enclosing 4–7 flowers and maturing 2–4 capsules, which are somewhat obovate and transversely wrinkled when mature; seeds obtusely angled and distinctly roughened, about 10 to the cell, light purple; petals 4–6″ long, toothed or slightly mucronate; stamineal column nearly 3″ long and pubescent at the base. The stem is narrowly margined.—Zuñi, New Mexico, 6,500 feet elevation (171).

SISYRINCHIUM ARIZONICUM, Rothrock, Bot. Gazette, vol. 2, p. 125.—1–2 feet high; stem proper smooth, ancipital; leaves 6–12 inches long, 2–6 lines wide, gradually attenuate into an acute point, 2–4 distinct white ribs in centre, and one or more less distinct toward either margin, minutely pruinose-glandular, slightly roughened on the margin; spathe of two lanceolate leaves regularly tapering to the top, somewhat shorter than the peduncles, of which each branch bears from 2–5 (most frequently 2); flowers yellow, 1–1½′ in diameter, bright yellow segments of the perianth broadly lanceolate; anthers 6 lines long, linear, twice as long as the dilated fila-

ments, which are united about one-third their length; style cleft half-way down into linear divisions; seeds (*immature*) oval or nearly round, margined, on a funiculus longer than their diameter.—PLATE XXVI. Natural size. Fig. 1. Stamen, seen from outside. Fig. 2. The same, seen from inside the flower. Fig. 3. Style. Fig. 4. Flower, with perianth removed. Fig. 5. Mature capsule. All except the first enlarged about 5 diameters.

This handsome species (238) I discovered at Willow Spring, Arizona, at an altitude of 7,195 feet; grows in damp places. There are indications of its presence elsewhere in Arizona, and allied species are found in Mexico.

AMARYLLIDEÆ.

BY DR. GEORGE ENGELMANN.

AGAVE UTAHENSIS, Engelm., Bot. King's Report, 497; Engelm. Agav. in Trans. Acad. St. Louis, 3, 308.—Stemless; leaves suberect, or outer ones spreading, lanceolate, tapering from a broad base, concave, 6–12′ long, 1–2′ wide, not constricted above the base, very thick, hard, glaucous and rough, terminating in a long (1 inch) pale spine, with broad whitish teeth on the margin; flowering stalk 5–7° high, with a spike-like raceme of yellow flowers each 1′ long, in pairs, or often in clusters of 4, on distinct pedicels; lobes 3 times longer than the funnel-shaped tube, which bears the stamens in the middle; filaments and style not much longer than the perigon; capsule oval subcylindric, about 1′ long.

Northern Arizona, Bischoff, to Southern Utah.

AGAVE PARRYI, Engelm. Agave, *l. c.* 311. (*A. Americana*, var. *? latifolia*, Torr. Bot. Mex. Bound. 213.)—Stemless; numerous short and broad (9–12′ long and 3–3½′ wide) leaves crowded around the base of the stalk pale, glaucous, with small, almost black, spiny, straightish teeth, and with a dark, horny margin toward the cuspidate tip, which terminates in a robust, somewhat triangular, black spine 1′ in length; stout scape 8–12° high, bearing a large, branched panicle of cream-colored flowers over 2′ in length; perigon deeply 6-parted; lobes twice as long as tube, which bears the long-exsert stamens in its throat; capsule broadly oval, sessile; seeds larger than in either of the other species.

Western New Mexico and Northern Arizona; Rocky Cañon, Rothrock (274), in 1874. Parry, Bischoff, only fruit. Dr. Rothrock's observations and very complete specimens enabled me to give a connected account of this species, of which fragments only had been known for many years. Rev. Mr. Greene noticed the abundant secretion of a sweetish liquid filling the tube, which has also been observed in other species. The rootstock is used as a substitute for soap by the natives, under the name of Amole, much like that of Yucca, and, when roasted, is considered a great delicacy, named Mezcal.

AGAVE PALMERI, Engelm. Agave, *l. c.* 319.—Stemless; leaves lanceolate, 10–20′ long by 2–2½′ wide, attenuate into a slender, terete, narrowly channelled, brown spine; marginal teeth flexuous or recurved, dark brown; scape as in the last; panicle loosely branched; flowers 2′ long; perigon whitish, lobes a little shorter than tube, stamens from its middle, and, together with anthers and style, long exsert, purplish; capsule cylindric, stipitate; seeds small, roughish.

Camp Bowie, Arizona, Rothrock (496), 1874; Palmer, in Southern Arizona. Similar to the last, but readily distinguished by its longer, narrower leaves and the other characters enumerated. Used for the same purposes as the last.

ALISMACEÆ.

TRIGLOCHIN PALUSTRE, L.—South Park, Colorado (952).

TRIGLOCHIN MARITIMUM, L.—Alkaline plains of South Park and San Luis Valley, Colorado (942, 951).

NAIADEÆ.

POTAMOGETON GRAMINEUS, L., var. HETEROPHYLLUS, Fries.—South Park, at 10,000 feet elevation (961). No mature fruit.

POTAMOGETON PERFOLIATUS, L., var. LANCEOLATUS, Robbins?—Twin Lakes, Colorado (960).

POTAMOGETON MARINUS, L.—Twin Lakes and San Luis Valley, Colorado (955).

POTAMOGETON PECTINATUS, L. (959).

NAIAS MAJOR, Roth.—Huntington Valley, Nevada.

TYPHACEÆ.

SPARGANIUM EURYCARPUM, Engelm.—Swamps of the San Luis Valley (956).

SPARGANIUM SIMPLEX, Huds.—Twin Lakes (957); swamps of the San Luis Valley (958).

LILIACEÆ.

FRITILLARIA ATROPURPUREA, Nutt.—Nevada.

FRITILLARIA PUDICA, Spreng.—Nevada.

LILIUM PHILADELPHICUM, L.—Central Colorado.

LLOYDIA SEROTINA, Reich.—South Park, Colorado (943).

CALOCHORTUS NUTTALLII, T. & G.—Utah; also a small-flowered form from Fort Wingate, New Mexico (148).

CALOCHORTUS GUNNISONI, Watson (vol. v, King's Report, p. 348).—Central Colorado (941); also Eastern New Mexico.

LEUCOCRINUM MONTANUM, Nutt.—Clear Creek Cañon, Colorado (944).

ALLIUM CERNUUM, Roth.—South Park, Colorado (948).

ALLIUM ATRORUBENS, S. Watson (King's Report, vol. v, plate xxxviii).—Nevada.

ALLIUM RETICULATUM, Fras.—Denver, Colo. (946).

ALLIUM MUTABILE, Mx.—South Park, Colorado (947); Willow Spring, Arizona, 7,195 feet elevation (237).

ALLIUM SCAPOSUM, Benth.—Small-flowered form from White Mountains of Arizona, at 8,200 feet elevation (197). Vol. v, King's Report, plate xxxviii, figs. 10 and 11.

ALLIUM ANCEPS, Kellogg.—Mineral Hill, Nevada.

CAMASSIA ESCULENTA, Lindl.—Independence Valley, Nevada.

MILLA BIFLORA, Cav.—Southern Arizona at 5,550 feet elevation (523).

ECHEANDIA* TERNIFLORA, Ortega.—Smooth, 6′–2° high; linear leaves

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*ECHEANDIA, Ortega.—Divisions of the perianth 6, with three nerves in the middle of each. Stamens 6, inserted on the base of the perianth divisions, subhypogynous; filaments retrorsely serrulate. Anthers oblong, divided below; style somewhat club-shaped; stigma three-lobed (slightly) and papillose; capsule globose, 3-celled; ovules in 2 rows in each cell; seeds orbicular, compressed; roots fibrous-fascicled; leaves linear, radical, ensiform; inflorescence racemose, with two to three flowers, on jointed pedicels, from each bract.

hardly as long as the scape; flowers 8″ in diameter, dark orange-yellow, on pedicels jointed *at or below* the middle; seeds 4–7 in each cell, black. Stamens shorter than the style. From the descriptions and from the scanty material at my command, I infer that this is an excessively variable plant.—Southern Arizona (537).

SMILACINA STELLATA, Desf.—Utah, and South Park, Colorado (953).

YUCCA* BACCATA, Torr.—A stout species, northward stemless, southward with a low or higher trunk; leaves rigid and rough, 1–3° long, 1–2′ wide, with a stout terminal spine, the margin with few but thick fibres; panicle oval, almost sessile, with large, thick, whitish bracts; flowers mostly large, 2–3′ long; fruit pendulous, pulpy, containing numerous thick seeds.—Bot. Mex Bound 221; Engelm. Trans. Ac. St. Louis, 3, 44.

Arizona (only fruit collected) to New Mexico and South Colorado, extending into Southern California and Northern Mexico.—One of the coarsest-looking species of this beautiful genus, remarkable especially for its pendulous, edible fruit, which are called dates or bananas by the settlers, and are eaten by the Indians and others.

YUCCA ANGUSTIFOLIA, Pursh.—A stemless or almost stemless plant, with very rigid and sharp-pointed, linear, sparingly filamentose leaves 1–2° long and 3–6″ wide; raceme almost simple, spike-like, sessile; flowers usually greenish-white; dry capsule erect, large (2½–3′ long and half as wide), opening with three valves through the dissepiments, each usually splitting again at tip; seeds very thin, flat, 5–6″ in diameter.—Engelm. *l. c.* 50.

Santa Fé, New Mexico, Rothrock (66), and from the Missouri plains to Texas and Arizona.

A more showy variety is *β. elata*, Engelm. *l. c.*, with a trunk several feet high, very rigid, glaucous leaves, often almost without fibres on the edge; an expanded branching panicle, with larger, showy, white flowers.—Camp Grant, Arizona, Rothrock (382), and Dr. Palmer.

VERATRUM† ALBUM, L.—Mount Graham, Arizona, at 9,500 feet elevation (395); Utah.

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*Dr. Engelmann has kindly furnished the portion on Yucca.

†This specimen was first named as above. Since this, however, Mr. Watson has marked a specimen for the Philad. Acad. Nat. Sciences as *Veratrum Californicum*, Durand. In vol. v, King's Report, p. 344, he regards Durand's species as a more loosely panicled form of *Veratrum album*, L., and also consid-

ZYGADENUS GLAUCUS, Nutt.—Colorado (950). Also from the Mogollon Mesa of Arizona a form corresponding well with the description and with other specimens, save in the shape of the gland, which extends across the lobes of the perianth, but has sometimes no upward heart-shaped divisions whatever (103), Loew. The shape of the gland, I am convinced, is quite too inconstant to serve as a specific test. A specimen from Anticosti Island has exactly the gland of *Z. Fremontii*, Torr., and yet is in all other respects a good *Z. glaucus*.

ZYGADENUS ELEGANS, Pursh (Fl. N. Am. vol. 1, p. 241).—1–2° high, slender, upper leaves few, one or two somewhat elongated but not exceeding the stem; lower leaves narrow (4–6″ wide), equal to or exceeding the stem; pedicels in the developed flower 8–12″ long, slender, exceeding the narrowly lanceolate, thin, veined bracts; flowers "white" or yellowish-white, 8–10″ in diameter; divisions of perianth oblong, obtuse, longer than the stamens; racemes often paniculate at base; oblong ovules in two rows, 20–25 in each cell. In my specimens of this species, the glands are usually deeply and obtusely two-lobed, with the lobes entire and the veins indistinctly seen. In a specimen of *Z. chloranthus*, Rich. (for which species I at first took this), from Fort Yukon, Alaska, the glands are less deeply lobed, with the lobes truncate and distinctly toothed, and the veins quite plainly seen. Not only do these shapes and divisions differ in the same species, but often markedly in the same flower.

By Pursh, the flower is said to be white, the petals acute, and the gland cinnabar-colored, in which points my specimens certainly do not agree with the description. Mr. Watson, on comparing this with the plants in the Cambridge herbarium, names it as above; and I do not hesitate to accept his determination —Mogollon Mesa, Arizona, Loew (103); Willow Spring, Arizona, at 7,195 feet elevation (243).

ZYGADENUS NUTTALLII, Gray.—Apex, Colorado (944).

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ers our eastern *V. viride*, Ait., as differing from *V. album*, L., "only in the green herbaceous perianth, the segments perhaps rather less attenuate at base, the panicle more open and with longer branches." The Oregon form (probably the same with which Durand contrasted his *V. Californicum* in Plant. Pratten. Calif. p. 103) Mr. Watson decides to be *V. Eschscholtzii*, Gray.

Comparing the specimen (395) from Mount Graham with an eastern *V. viride*, Ait., I find the latter to have much longer (relatively) and more delicate filaments, and the *unopened* anthers to be just a little retuse at the apex, giving them, *when fully opened*, the appearance of a slightly four-lobed disk.

XEROTIDEÆ.

DASYLIRION* GRAMINIFOLIUM,† Zucc.—Caudex 4° high; scape 8–10° high, 2′ in diameter; leaves 2° long, 6–10″ wide, spiny serrated; spikes of the flowering panicle subtended by lanceolate, clasping bracts; perianth white or whitish; filaments much exceeding the lobes; embryo cylindrical, in the centre of a hard, horny albumen and nearly as long; fruit whitish, with a purple tinge, conspicuously 3-winged.—Southern Arizona (329, 655).

DASYLIRIUM ERUMPENS, Torr.—Caudex and scape 6° high; leaves linear, 2–3° long, 4–6″ wide at base, and regularly tapering to the tip, semi-terete below, channelled above, edges rough; fruit 3-lobed, 3-celled, and not winged (but appearing so from the diverging cells), broader than long, thin, membranous, and burst by the maturing seed; the sheathing bract at base of each primary branch attenuate into a long filiform tip.—Rocky Cañon, Arizona (278).

This my friend Mr. Watson has named *Lindheimerianum*, but it corresponds so well in its fruit and leaves that I have named it as above.

JUNCEÆ.

BY DR. GEORGE ENGELMANN.

JUNCUS BALTICUS, Deth., γ. MONTANUS, Engelm. Revis. Junc. in Trans. Acad. Saint Louis, 2, 442.—A smaller inland form of this species, with nearly equal segments of the perigon, longer, beaked capsule, and slender, pointed seeds.—Colorado; New Mexico to Nevada; Rothrock (23).

JUNCUS TRIGLUMIS, Linn.—Cæspitose, with short subulate leaves, channelled near the base; naked stems 3–5′ high, bearing a terminal head of 2 or 3 flowers, enclosed in large broad bracts; obtusish sepals shorter than the oblong, obtuse, mucronate capsule; filaments many times longer than the small anthers; large seeds loosely enveloped in the striated coat, appen-

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* DASYLIRION, Zucc.—Flowers diœcious. Male-flowers 2–3 in clusters, enclosed in thin, hyaline, somewhat fimbriate bracts; pedicels 1–2″ long, jointed above; perianth of 6 similar white or whitish divisions; filaments attached to the base of the divisions; pistil abortive. Female flowers in bracteate clusters, like the males; ovary sometimes 1-, sometimes 3-celled, with usually 6 ovules, of which but one or two mature into seeds.—Erect, hard herbs, with clusters of narrow, recurved leaves crowning the caudex. Scape 6–14° high, terminated by large masses of small flowers. The ends of the leaves usually split up into white, thin, strong fibres, which could doubtless be utilized in the manufacture of cordage.

† *Dasylirion graminifolium*, Zucc. Since the above was put in type, Mr. Watson has determined this plant to be a new and clearly distinct species, which he names *D. Wheeleri*. See note under Table of Orders, at end of volume.

daged at both ends.—Twin Lakes, Colorado (J. Wolf), and generally on the alpine summits of the Rocky Mountains and northward; also in Europe

JUNCUS CASTANEUS, Smith.—Stems from a creeping rhizoma, about a span high, naked or with one or two leaves; basal leaves shorter than the stem, rather stout, channelled below, nearly terete upwards; single or few large, few-flowered heads generally from a foliaceous sheath; deep brown flowers $\frac{1}{4}'$ long; anthers half as long as filaments; prismatic capsules much longer than flowers; seeds $\frac{1}{2}''$, or with the appendages $1\frac{1}{2}''$ long.—Mosquito Pass, Colorado, J. Wolf (933), and generally on the alpine heights of the Rocky Mountains, to the northwest coast, and in similar regions of the Old World. A very conspicuous form; flowers and seeds among the largest in the genus.

JUNCUS TENUIS, Willd.—Throughout Colorado and New Mexico.—Rothrock (45), in 1874.

JUNCUS BUFONIUS, Linn.—San Luis Valley, Colorado.

JUNCUS LONGISTYLIS, Torr. Bot. Mex. Bound. 223; Engelm. Junc. 453.—Cæspitose, stoloniferous plants, with flat, grass-like leaves, erect stems 1–2° high, bearing large, few-flowered heads, single or several in an elongated, strict panicle; flowers $2\frac{1}{2}$–$3''$ long, with ovate-lanceolate, acute sepals, of nearly equal length; anthers much longer than the filaments; prismatic capsule obtuse, mucronate, about as long as sepals; seeds ovate, abruptly pointed at both ends, striate-reticulate.—Rocky Mountains to California; Twin Lakes and South Park, Colorado, Wolf; Santa Fé, Rothrock (1005), with fewer and larger heads, and Ash Creek, Arizona (308), with smaller, few-flowered heads in a panicle 3–5′ long.

JUNCUS MARGINATUS, Rostk.—Camp Lowell, Arizona, Rothrock (711), the most western locality known for this species. A form with all the sepals acute and aristulate.

JUNCUS NODOSUS, Linn., var. MEGACEPHALUS, Torr.—San Luis Valley, Colorado, J. Wolf; Rothrock (174), from Zuñi, New Mexico.

JUNCUS MERTENSIANUS, Bong.—Stems cæspitose, from a stout creeping rhizoma, a span to a foot high, weak, compressed, leafy; leaves compressed from the sides, indistinctly cross-partitioned, mostly auricled at the sheaths;

heads few, rather large, deep brown or blackish; flowers about 2″ long, outer sepals acute, inner mostly shorter and obtuse, mucronate, rarely similar to the outer ones; stamens 6, or sometimes 3; filaments as long as anthers, or longer; ovary and capsule obovate, obtuse, abruptly pointed by the short style; seeds obovate, short-tailed at both ends.—Highest mountains of Colorado; Mosquito Pass; Twin Lakes, Wolf; and northwestward to Alaska.

JUNCUS XIPHIOIDES, E. Meyer, var. MONTANUS, Engelm. Junc. l. c. 481.—Stems flattened, ½–1½° high, with laterally compressed, slightly cross-partitioned leaves, mostly auriculate at sheaths; heads few, many-flowered, light or darker brown; flowers smaller than in the last; all sepals acute, inner ones shorter; stamens 6; capsule oval, rostrate, about as long as sepals; seeds oblanceolate, and pointed at both ends.

Sierra Blanca, Arizona, Rothrock (808), at 12,000 feet altitude, and through the Rocky Mountains to California and Oregon. Our specimens show only 1–3 heads, but at Zuñi, New Mexico, Dr. Rothrock collected a form (170) over 2° high, with few- (3–5-) flowered heads in compound panicles; sepals very acute, of equal length; anthers half as long as filaments; capsule (immature) rostrate. This form seems to stand near the original type from the Pacific coast, or to form a transition from it to *J. oxymeris*.

COMMELYNEÆ.

TRADESCANTIA VIRGINICA, L.—The narrow-leaved forms (372, 118), New Mexico; also Camp Grant, Arizona.

CYPERACEÆ.

CYPERUS NUTTALLII, Torr.—A small form, with three stamens and three stigmas.—Sanoita Valley, Southern Arizona (599).

CYPERUS INFLEXUS, Muhl.—San Luis Valley, Colorado (979), and Southern Arizona (600 *a*, 602, 369).

CYPERUS SCHWEINITZII, Torr.—Colorado; also Willow Spring, Arizona, at 7,500 feet elevation.

CYPERUS CEPHALANTHUS, Torr.—Culm sharply 3-angled; angles decidedly rough; sides hispidly pubescent; leaves shorter than the stem, rough-

margined, 3–4″ wide (radical, and toward lower part of the stem); involucre 3-leaved, leaves much exceeding the umbel; 3–4 rays of the umbel erect, many 8–14-flowered spikelets agglomerated into an oblong head; scales ovate, obtuse, 7–9-nerved, sides brown and midrib green; the bracts subtending the spikelets setaceous, nearly as long as the spikelet; achenia triangular-ovate, somewhat shorter than the scales; stigmas 3; stamens 3.—Sanoita Valley, Arizona (600, 601).

Cyperus rotundatus, L., var. Hydra, Gray.—Nevada.

Cyperus phymatodes, Muhl. (*C. repens*, Ell.; Bot. Mex. Bound.).—Southern Arizona (365, 400 *a*).

Hemicarpha subsquarrosa, Nees.—A luxuriant specimen from Camp Lowell, Southern Arizona (715). It appears to me as though this genus rests on insufficient foundation, the inner scale being so often reduced to a minimum, *and at times is wanting altogether.*

Eleocharis palustris, R. Br.—Camp Grant, Arizona, furnishes a specimen (380) with the bristles shorter than the achenium; San Luis Valley, Colorado (927, 977).

Eleocharis acicularis, R. Br.—Alkaline flats of San Luis Valley, Colorado (928). Bristles twice as long as the achenium.

Scirpus pauciflorus, Lightfoot.—Twin Lakes, Colorado (926).

Scirpus pungens, Vahl.—Denver (925), and Gila Valley, Arizona, at 3,080 feet elevation (336). Nevada.

Scirpus validus, Vahl.—San Luis Valley (930); Western New Mexico, at 6,500 feet elevation (104, Loew); also Arizona (330 *a*), with bristles to fruit longer than achenium; and Nevada.

Scirpus maritimus, L.—Nevada.

Eriophorum polystachyon, L.—Twin Lakes (968).

Fimbristylis capillaris, Gray.—Southern Arizona (611, 624). Quite variable in size and in shape of fruit.

Cladium effusum, Torr.—Culms nearly terete, 3–7° high; elongated, linear leaves acutely serrate on back and margin; spikes small, several in a cluster, forming large, loose panicles; scales 4–7, the lowest empty, the top one with a perfect flower, and the one below it with a staminate flower.—Nevada.

KOBRESIA* SCIRPINA, Willd.—Cæspitose, 5–8′ high; leaves shorter than the stem, the few small brown spikelets clustered into a short terminal spike; lower flowers are female, and the upper ones male.—Colorado.

CAREX† GYNOCRATES, Wormsk.—Mosquito, Colorado (1000); Twin Lakes, Colorado, Professor Wolf.

CAREX SCIRPOIDEA, Mx.—South Park, Colorado (1002); Mosquito, Colorado; Professor Wolf.

CAREX POLYTRICHOIDES, Muhl.—Twin Lakes, Wolf (1004).

CAREX OBTUSATA, Lilij.—South Park, Colorado (1003).

CAREX LYONI, Boott.—Twin Lakes, Colorado (1001).

CAREX SICCATA, Dew.—South Park (1009); Mosquito, Colorado (1008).

CAREX DOUGLASII, Boott.—Santa Fé, N. Mex. (31); Denver (1010). Var. MINOR at Twin Lakes (1011).

CAREX GAYANA, Desv.—1–2° high, slightly scabrous above; leaves 1–2″ wide, shorter than the culm; spikes ovate or oblong, of numerous crowded spikelets, the lower sometimes compound, diœcious, or male with a few female flowers, or female with a few male flowers, naked or with one or two clasping setaceous bracts shorter than the spike; perigynia dark chestnut-colored, shining, plano-convex, tapering to a very short conical beak, whitish at the nearly entire orifice, serrate above on the obtuse margins, marked in front toward the somewhat cordate base with a longitudinal furrow and a few nerves, nerveless on the back, the walls thick and spongy; stigmas 2; scale chestnut-colored, more or less hyaline on the margins, ovate-acuminate, cuspidate, longer than the perigynia; achene orbicular, dark chestnut.—Willow Spring, Arizona (232); South Park, Colorado (225, 383, 384, very young). Otto Böckeler, in the Linnæa, vol. 39, p. 54, quotes *C. Gayana* as a synonym of *C. divisa*, Huds. But the often diœcious spike of *Gayana*, its few-nerved, furrowed perigynium with

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* KOBRESIA, Willd.—"Perennial herbs, with grass-like leaves, radical or sheathing the stems at the base. Spikelets sessile in a terminal spike, simple or rarely branched at the base, with a glume-like bract under each spikelet. In each spikelet the lowest glume encloses an ovary with a long trifid style, the next one, or rarely 2 glumes, enclose 3 stamens, and there is often a small rudimentary glume or awn terminating the axis. Some spikelets have only one glume, enclosing an ovary, and some, near the end of the spike, have only one glume with 3 stamens."—Bentham's Handbook of the British Flora, p. 904.

†CAREX.—For the following careful elaboration of this genus, I am indebted to Mr. William Boott, of Boston.

obtuse margins and nearly entire beak, appear to distinguish it from *divisa*, which has a bidentate, many-striate perigynium, wing-margined above.

CAREX MARCIDA, Boott.—Twin Lakes (1012); Santa Fé, N. Mex.

CAREX VULPINOIDEA, Mx.—Tanks 26 miles south of Camp Apache, Arizona (267)

CAREX MURICATA, L.—Santa Fé, N. Mex. (46, is a very small form). Var. GRACILIS, Boott (*C. Hookeriana*, Dew.), South Park, Colorado (1006).

CAREX STENOPHYLLA, Wahl.—South Park (1012).

CAREX TENELLA, Schk.—Twin Lakes (1016).

CAREX CANESCENS, L.—Twin Lakes (1017) (1018 possibly *C. canescens*, Blytt).

CAREX ECHINATA, Murray (*C. stellulata*, Good.) (1018 in part).—Twin Lakes; also (214) from Willow Spring, Arizona, at 7,400 feet.

CAREX LIDDONI, Boott.—Colorado (1030 and 1031); Mount Graham, Arizona, at 9,000 feet elevation (427). Dr. Boott founded this species on specimens brought from the Columbia River by Dr. Scouler, and noticed its affinity to *C. arida*. It has since been found to have a wide range at the West, and to be very variable, approaching *C. leporina*, L.

CAREX LEPORINA, L.—Colorado, Wolf (1024, 1025).

CAREX FESTIVA, Dew.—Mosquito, Colorado (1020); Mount Graham, Arizona, at 9,000 feet (430).

CAREX ADUSTA, Boott.—Colorado, Wolf (1028, 1029).

CAREX RIGIDA, Good. (*C. vulgaris*, Fries, var. *alpina*, Boott.)—Chiricahua Creek, Arizona; also Mosquito, Colorado (1035, 1036), Wolf.

CAREX VULGARIS, Fries.—Twin Lakes, Colorado (1039.)

CAREX AQUATILIS, Wahl—South Park (1034). Var., Twin Lakes (1037, 1038, Wolf), 18′ high, very slender, with 1–2 male and 1–2 linear-clavate, loosely flowered, exsertly pedunculate female spikes; bracts shorter than the culm; perigynia (very young) obovate, nerveless, abruptly terminated by an extremely short, entire beak, broader and shorter than the lanceolate purple scales which have a pale midrib.

CAREX JAMESII, Torr.—Denver, Colorado (1032); Willow Spring, Arizona, at 7,195 feet (216). (No. 245, from Willow Spring, resembles *C. acuta*, L., but the bracts are shorter and the perigynia bidentate.)

CAREX DECIDUA, Boott.—Willow Spring, Arizona, at 7,195 feet elevation (233), Rothrock.

CAREX BUXBAUMII, Wahl.—Twin Lakes, Colorado (1042).

CAREX ATRATA, L.—South Park (1046). Var. NIGRA (*C. nigra*, All.)—Oro City, Colorado (1047). Var. OVATA (*C. ovata*, Rudge.)—South Park (1050, 1051). Var. from Mount Graham, Arizona, at 9,000 feet (431), with cylindrical spikes on elongated weak peduncles.

CAREX ALPINA, Sw.—South Park, Wolf (1043).

CAREX PARRYANA, Dew.—Smoothish, 4–18′ high; leaves $\frac{1}{8}$′ wide, with revolute margins, tapering to a long slender point, shorter than the culm; spikes oblong or cylindrical, either single, diœcious, or 1–4, the uppermost much the largest, about 1′ long, male, or female with scattered male flowers, the others female; bracts 1–2, slender, the lowest shorter than the culm, with connate purple auricles forming a short (1–2″ long) sheath; perigynia triquetrous, broadly ovate or obovate, emarginate, serrate-ciliate on the margins above, about the length of the broadly ovate, obtuse, mucronate, purple scales with hyaline margins; nerves 2, marginal; stigmas 3; achene *obovate*, triquetrous.—South Park (1040, 1041).

CAREX AUREA, Nutt.—Twin Lakes, Colorado (1052–1057). Willow Spring, Arizona, at 7,195 feet (215); a tall form, with short bracts.

CAREX ROSSII, Boott.—Twin Lakes (1058).

CAREX CAPILLARIS, L.—South Park (1059). Var. ELONGATA, Torr., Twin Lakes (1060).

CAREX LANUGINOSA, Mx.—Twin Lakes (1061, 1062). Willow Spring, Arizona, at 7,195 feet (241).

CAREX ARISTATA, R. Br.—A single specimen without number or ticket.

CAREX sp.? (1064), Colorado. Too young to determine.

CAREX UTRICULATA, Boott.—Twin Lakes, Colorado (1069) (1068, with more globular fruit, resembling *C. ampullacea*, Good., common in the Eastern States). Var. GLOBOSA, Olney, Sierra Blanca, Arizona (806).

CAREX VESICARIA, L., var. ALPIGENA, Fries. (*C. saxatilis*, L.; *C. pulla*, Good.; *C. Grahamii*, Boott.)—6–24′ high, sharply angled, rough above; leaves 2″ wide, shorter than the culm, tapering to a long, triquetrous apex; male spikes 1–2, about 1′ long, female 1–3′ long, 3″ wide, oblong or cylin-

drical, subremote, the lowest peduncled; perigynia shining, pale or purple, oblong-ovate, tapering to a cylindrical bidentate beak, nerveless or faintly nerved, twice the length of the scale; scales purple, with pale midnerve, male oblong obtuse, female ovate acute; bracts leafy, clasping, longer than the culm, evaginate, or occasionally there is below the fertile spikes an empty bract with a vagina $\frac{1}{2}$–1′ long; stigmas 2–3 (1071–1072, 1070).

Drejer, Revista Crítica, p. 57, says that the Greenland specimens of *pulla* are two or three times *larger and more robust* than Iceland ones, occurring with 1–3 approximate or very remote round ovate, acutish or elongated cylindrical, obtuse female spikes; with scales obtuse, shorter, or acute, longer than the perigynia; stigmas 2–3. In the Linn. Trans., Dr. Boott states that Lapland specimens in the Linnæan Herbarium and the description in the Flora Lapponica prove *C. pulla*, Good., to be the original *C. saxatilis* of Linnæus, but that afterwards Linnæus in the Flora Succica and the Species Plantarum confounded it with *C. rigida*, Good., which has since with European botanists generally borne the name of *saxatilis*. Hooker and Arnott in the British Fl. consider *C. Grahamii* to be a variety of the original *saxatilis* of Linnæus. Anderson, Cyper. Scand., names it *C. vesicaria*, var. *dichroa*. Dr. Boott finally thought it to be the var. *alpigena*, Fries, of *vesicaria*.

The following, belonging to the *vesicaria* group, with immature fruit, do not admit of accurate determination or full description.

Carex sp.?, probably new, 2° and over high, pale, slender, smooth and spongy at bottom, slightly scabrous above; leaves 3″ wide, much exceeding the culm; male spikes 3–4, $1\frac{7}{8}$ inches long, contiguous (in one specimen male spikes 4, distant, occupying a space of 4′ on the culm); female spikes 3–4, oblong cylindrical, 1–2′ long, $\frac{3}{8}$′ wide, 1–3′ below the male, and 1–$5\frac{1}{2}$′ apart, the uppermost sometimes staminate at top and at bottom, the lowest on short peduncles; bract of lower male spike filiform, exceeding its spikelet; bracts of female spikes evaginate, clasping conduplicate at base, much longer than the culm; perigynia (very young) widely spreading, ovate, with a rather long, cylindrical, sharply toothed beak, conspicuously nerved; scale 3-nerved, purple, with pale midnerve, the male oblong-linear, obtuse, female lanceolate or lanceolate-ovate, taper-

ing to a rough point, shorter than the perigynia; 4 specimens of the Expedition collection received from Washington without number or ticket.

CAREX sp.?—$1\frac{1}{2}^{\circ}$ high, smoothish; leaves (broken) $\frac{1}{8}'$ wide; bracts evaginate, the lower male filiform, exceeding the spikelet, the female broad, plane, exceeding the culm; male spikes 3–4, overlapping, uppermost 1′ long; female spikes 1–2, oblong or cylindrical, 1′ long, 3″ wide, 1–3′ below the male, 1–2′ apart, occasionally with an empty bract 4–8′ below the spikes; perigynia (very young) ovate, spreading, tapering to a cylindrical beak, with short teeth, delicately nerved; stigmas 3; scales 3-nerved, purple, with pale margins and midnerve, the male oblanceolate obtuse, the female lanceolate or ovate, shorter than the perigynia; vagina of empty bract 6″ long.—Willow Spring, Arizona, Rothrock (231).

CAREX sp.?—2^{c} high or more, stout, glaucous, smooth and spongy below, slightly scabrous above, and with the leaves thickly nodose-reticulated; leaves 3″ wide, much longer than the culm; male spikes 4, overlapping, about 1′ long, rarely with a few female flowers at top and at bottom; female spikes 2, $\frac{3}{4}$–$1\frac{1}{2}'$ long, $\frac{3}{8}'$ wide, about 9″ below the male, 1–4′ apart; sometimes staminate at top, the lowest on a short peduncle; bracts of the lowest male spike shorter than the culm, clasping, with connate purple auricles; bracts of the female spikes much longer than the culm, with vaginæ $\frac{1}{8}$–$\frac{1}{4}'$ long. In the vagina of the lowest spike, the lamina opposite the bract is extended above to an obtuse point. Below the female spikes there is sometimes an empty bract with a vagina 9″ long; perigynia (very young) squarrose, broadly ovate, abruptly ending in a stout, cylindrical, obliquely cut, minutely toothed, strongly nerved beak, purple at the orifice; stigmas 3; scales 3-nerved, purple, with pale midnerve, the male oblong linear, obtuse, the female lanceolate acute, as long as the perigynia. The pale fruit and purple scales give the female spikes a variegated appearance.—Colorado (460).

CAREX sp.?—Culm and leaves as in the last; male spikes 3–4, contiguous, the upper 1–2′ long, naked or rarely the lower with a filiform, clasping bract exceeding its spikelet; ferti[l]e spikes 2, narrow-cylindrical, often staminate to near the base, $1\frac{1}{2}$–2′ long, 1–$2\frac{1}{2}'$ below the male, and about 2′ apart, sometimes with a lower, 4–8′ distant, empty bract, the upper sessile, the lower

in a short, included peduncle; perigynia ovate, nerved, tapering to a cylindrical beak, with short teeth; bracts of female spikes evaginate, clasping, or of the empty bract with a vagina 6″ long, exceeding the culm; scales 3-nerved, purple, with pale margins and midnerve, the male linear-oblong, acutish, the female lanceolate, tapering to a sharp rough point, longer than the perigynia.—Saguache Creek, Colorado, Wolf (1065). While the culm, leaves, and male spikes in these specimens are fully developed, the female spikes appear to have been arrested in their growth. In the disposition of the spikes, they resemble *aristata*, but the short teeth of the perigynia exclude them from that species.

GRAMINEÆ.

By George Vasey, M. D.

Alopecurus aristulatus, Michx.—Twin Lakes, Colorado, 1873 (1073); Santa Fe, N. Mex., 1874 (32). Varies much in the length of the awn, which is sometimes shorter, sometimes longer than the palet,—sometimes, indeed, as in No. 390, Palmer, 1868, twice as long as the palet, in which case it is hardly to be distinguished from *A. geniculatus*, L., of which it is considered a variety by Steudel. There is an equal variation in the stoutness of the culm.

Phleum alpinum, L.—Twin Lakes and South Park, Colorado, 1873 (1074).

Hilaria* cenchroides, H. B. K.—Culms stoloniferous, 1 foot or less high, frequently rooting at the pubescent nodes; leaves flat, narrowly linear; spike terminal; rachis flattened, flexuous, of 8–10 joints; spikelets in threes, which are connate at the base and alternate on the rachis.—Sanoita Valley, Arizona (595).

Vilfa cuspidata, Torr.—Twin Lakes, Colorado, 1873 (1075, 1076). In some specimens, the glumes are acute and in others obtuse; indeed,

*Hilaria, H. B. K.—Panicle spike-like, spikelets sessile, in threes, which are connate at the base, the two anterior ones male and from 1- to 3-flowered, the posterior female and 1-flowered. Male flowers: glumes 2, unequal, the lower one bifid and aristate, the upper one emarginate and mucronate; palets linear-oblong, emarginate and rounded at the apex, stamens 3.—Female flowers: glumes 2, opposite, alike, unequally 2-lobed, aristate between the lobes; palets 2, expanded at the base, and abruptly narrowed into a long neck, inferior one 3-nerved, superior one 2-nerved; styles 2; grain oblong, compressed, free between the 2 valves.

there seem to be no good characters to distinguish this from *Vilfa depauperata*, Torr.

VILFA MINIMA, Vasey.—Culms erect, 1–1½′ high, branched at the base, slender; spikes simple, few-flowered, terminal and lateral, the lateral ones partly enclosed in the loose sheaths; flowers alternate, half a line long, pointed; glumes membranaceous, obtuse, about half as long as the flowers; palets nearly equal in length; leaves mostly radical, short (¼–½′), strongly nerved; lower sheaths inflated. This diminutive grass appears to be annual, very slender and delicate.—On wet, sandy shores around Twin Lakes, Colorado, 1873 (1077), appears somewhat like *V. depauperata*, var. *filiformis*, but is distinct.—PLATE XXVII. Fig. 7. Plant, natural size. Fig. 8. Flower, magnified 15 diameters. Fig. 9. Cross-section of stem, greatly magnified.

VILFA (SPOROBOLUS) CRYPTANDRA, Torr.—Nevada, Arizona, and Utah, 1871, and 1872; Arkansas Valley, 1873 (1078). Var. FLEXUOSUS, Thurb., Nevada and Arizona, 1871 and 1872. In the variety, the panicle is longer and more slender, and the branches are capillary and flexuous.

VILFA (SPOROBOLUS) AIROIDES, Trin. (Watson's Botany 40th Parallel).—Called salt-grass and used for pasturage. Grows in alkaline soil. Nevada, 1871 and 1872; Colorado, 1873 (1079); Deer Springs, Arizona, 1874 (185); Albuquerque, N. Mex., 1874 (122); Sulphur Springs, Arizona, 1874 (550). The leaves of this species and also of the preceding furnish a strong fibre, which might be utilized in making paper or cordage.

VILFA (SPOROBOLUS) ASPERIFOLIA, N. & M.—Nevada and Utah, 1871 and 1872; Cottonwood Creek, Colorado, 1873 (1081); Saguache Creek, Colorado, 1873 (1082); Sanoita Valley, Arizona, 1874 (692). No. 1082, from Colorado, is a very luxuriant form, in which many of the specimens have 2–3-flowered spikelets. Many of these have the grain affected with a black smut. No. 692 is a long-stemmed, procumbent form.

VILFA (SPOROBOLUS) RAMULOSA, H. B. K. (Watson's Botany of the 40th Parallel).—Saguache Creek, Colorado, 1873 (1080).

VILFA TRICHOLEPIS, Torr. (Synopsis of Flora of Colorado).—Mount Graham, Arizona, 1874 (745); Sierra Blanca (801). Called bunch-grass in Arizona; makes an excellent forage (Dr. Rothrock).

VILFA RIGENS, Trin.?—Culm erect, 2–3° high, simple; leaves erect, coriaceous, convolute, pungent; radical ones very long (1° or more); panicle strict, erect, 1–1½° long, interrupted below, the base frequently included in the upper sheath; rays short, appressed, floriferous to the base; spikelets 2″ long, smooth; inferior glume one-fourth shorter than the valve. Arizona, 1871 and 1872.

AGROSTIS PERENNANS, Tuck.?—Wet ground among the timber; Colorado, 1873 (1085).

AGROSTIS SCABRA, Willd.—Low ground, Twin Lakes, Colorado, 1873 (1083); South Park, Colorado, 1873 (1084); Willow Spring, Arizona, 1874 (225). A very slender form.

AGROSTIS EXARATA, Trin. (Watson's Botany 40th Parallel).—Twin Lakes, Colorado, 1873 (1086); Camp Apache, Arizona, 1874 (258).

AGROSTIS VERTICILLATA, Vill.—Root fibrous, culm procumbent, geniculate at the rooting or ascending nodes, sheaths smooth or pubescent, ligule 1–2″ long; leaves lanceolate-linear, 1–3′ long, 1–3″ broad, scabrous on the margins and above, rarely glabrous; panicle dense, 1–4′ long, more or less interrupted below; rays more or less verticillate (3–8 together), at the base branching and densely floriferous; glumes acute, nearly equal, 1-nerved; palets subequal, awnless, ⅓ to ½ shorter than the glumes.—Camp Bowie, Arizona, 1874 (449); Central New Mexico, 1874 (114).

AGROSTIS VULGARIS, With.—Twin Lakes, Colorado, 1873 (1087); probably introduced.

MUHLENBERGIA DISTICHOPHYLLA, Kunth—Root firm, fibrous; culm erect, 3–4° high, smooth, compressed, sheathed at the base by the distichous, coarse sheaths; leaves very long, rigid, flat or somewhat involute, compressed at the base, scabrous on the margin and keel; panicle often 1° or more long, contracted; rays solitary, thin, appressed, branched; glumes subequal, scabrous on the back, shorter than the palets; inferior palet 3-nerved, short pilose on the margin below; apex prolonged into a bristle 2½ to 5″ long; superior palet 2-nerved. The awn is wanting in some forms.—Rocky Cañon, Arizona, 1874 (282); an awnless form (283).

MUHLENBERGIA TEXANA, Thurb. (Synopsis of Flora of Colorada, p. 144).—Arizona, 1871; Cienega, Arizona, 1874 (574).

MUHLENBERGIA PUNGENS, Thurb. (Proc. Acad. Phil. 1863, p. 78; Synopsis of Flora of Colorado, p. 144).—Fort Garland, Colorado, 1873 (1088).

MUHLENBERGIA GRACILLIMA, Torr. (Syn. of Flora of Colorado, p. 144).—San Luis Valley, Colorado, 1873 (1091).

MUHLENBERGIA GRACILIS, Trin. (Steudel, Gram. p. 179).—Root fibrous; culm erect, slender, branching at the base, 8′ to 1½ or 2½° high, minutely scabrous, as well as the sheaths; leaves erect, narrowly linear, 1–12′ long, plane or convolute, rigid, retrorsely scabrous; panicle contracted, 2–8′ long; branches solitary, appressed; pedicels very short; glumes ovate, the lower 1-nerved and acuminate, the upper 3-nerved and 3-toothed, the teeth awl-pointed; palets lance-oblong, 2″ long, nearly equal, minutely scabrous, or somewhat pubescent on the nerves below, the upper with an awn 2–6″ long.—Twin Lakes, Colorado, 1873 (1089). The species as here defined embraces several varieties, two of which are represented in the collections.

MUHLENBERGIA GRACILIS, Trin., var. BREVIARISTATA.—Cæspitose, low (8–12′ high), often growing in ring-like patches; leaves very short, 1–3′, involute and rigid; panicle short, 2–3′, very close; awn of the upper palet about its own length.—Twin Lakes, Colorado, 1873 (1098).

MUHLENBERGIA GRACILIS, Trin., var. MAJOR.—Culm tall, 2 to 2½°, slender; leaves 6 to 8′ long; panicle 6 to 8′ long, lax, strict; glumes half as long as the palets; palets equal, minutely scabrous; awn 3–4 times as long as the palet.—Mount Graham, Arizona, 1874 (744). These forms seem to be sufficiently distinct for species, and may have been described under other names.

MUHLENBERGIA SYLVATICA, T. & G., var FLEXUOSA, Vasey, perhaps a new species. It is 731, C. Wright, New Mexico.—Culms about 2° long, slender, branching from the base and the lower half of the culm, the branches also floriferous; leaves narrow, 3′ long; panicle graceful, drooping, loose, somewhat contracted above, 3–5′ long; branches mostly single (below somewhat distant), lower ones 1½′ long, divided, and flowering to the base; pedicels very short; glumes ⅔ to ¾ the length of the flower, scarious, lanceolate, acute, 1-nerved, shortly 2-toothed, or with 1 or 2 short hairs (setæ) at the apex, scabrous on the midrib; palets conspicuously

pubescent below, especially on the nerves, nearly equal, lower one 3-nerved, upper 2-nerved; awn 7 to 10″ long. Panicle looser and awns longer than in *M. sylvatica*.—Camp Crittenden, Southern Arizona, 1874 (681).

VASEYA COMATA, Thurb. (Watson's Botany 40th Parallel).—Gravelly shores, Twin Lakes, Colorado, 1873 (1092).

CALAMAGROSTIS CANADENSIS, L., var. ROBUSTA.—A robust form, approaching *C. Langsdorffii*, Trin.—Twin Lakes, Colorado, 1873 (1093).

CALAMAGROSTIS STRICTA, Trin.—Twin Lakes, Colorado, 1873 (1096). Saguache Creek, Colorado, 1873 (1097).

CALAMAGROSTIS STRICTA, var. ROBUSTA.—Culms 2° high, stout, scabrous, as are the leaves and sheaths; leaves erect, 10–15′ long, plane or somewhat involute, slender pointed; panicle strict, rigid, rather dense; spikelets larger and coarser than in the preceding. This approaches *C. confinis*.—It occurs in many collections from the Rocky Mountain region. Twin Lakes, Colorado, 1873 (1099). Some specimens are affected with an ergot (1101).

CALAMAGROSTIS STRICTA, var. BREVIOR.—Very near the preceding variety, but with shorter, more rigid culms, and panicle partly included in upper sheath. This was in an earlier report referred to *C. Lapponica*, Trin.—Mosquito, Colorado, 1873 (1098).

CALAMAGROSTIS SYLVATICA, DC. (Watson's Botany 40th Parallel, Synopsis of Flora of Colorado).—Mosquito, Colorado, 1873 (1094); South Park, Colorado (1095).

ERIOCOMA CUSPIDATA, Nutt. (Watson's Botany 40th Parallel, Synopsis of Flora of Colorado).—Nevada and Arizona, 1871 and 1872; Denver, Colorado, 1873 (1102).

ORYZOPSIS MICRANTHA, Thurb. (Synopsis of Flora of Colorado).—Santa Fé, N. Mex., 1874 (44).

STIPA AVENACEA, L.—Camp Grant, Arizona, 1874 (456).

STIPA COMATA, Trin. (Watson's Botany 40th Parallel).—Agua Azul, N. Mex., 1874.

STIPA SPARTEA, Trin.—Utah, 1871 and 1872; Twin Lakes, Colorado, 1873 (1103).

STIPA VIRIDULA, Trin. (Watson's Botany 40th Parallel, Synopsis Flora

of Colorado).—Twin Lakes, Colorado, 1873 (1104); Arkansas Valley (1105); Mosquito, Colorado (1106); alpine woods, Colorado (1107 and 1108).

STIPA MONGOLICA, Turcz. (Watson's Botany 40th Parallel, Synopsis of Flora of Colorado).—Twin Lakes, Colorado, 1873 (1100).

STIPA PENNATA, L., var.—This species, of which little was collected, is easily distinguished by the awns, which are 6 inches or more long, twisted for 1½–2 inches below, the upper part flat and beautifully plumose-pennated.—Arizona. Locality not recorded.

STIPA OCCIDENTALIS, Thurb. (Watson's Botany 40th Parallel).—Nevada, 1871 and 1872.

ARISTIDA PURPURASCENS, Poir.—Arizona, 1871 and 1872.

ARISTIDA PURPUREA, Nutt. (Watson's Botany 40th Parallel, Synopsis Flora of Colorado).—Camp Bowie, Arizona, 1874 (481); Camp Grant, Arizona, 1874 (374).

ARISTIDA PURPUREA, Nutt., var. LONGISETA. (*A. longiseta*, Steud.)—Perhaps a distinct species.—Denver, Colorado, 1873 (1110); Santa Fé, N. Mex., 1874 (1).

ARISTIDA HUMBOLDTIANA, Trin. (*A. divaricata*, H. B. K.)—Root fibrous; culms cæspitose, erect, simple, 1–2° high; leaves convolute, rather short and rigid; panicle about 1° long, sheathed at the base, rays rather rigid, in twos or threes, mostly long (3–6′), flower bearing above the middle, inferior ones erect, superior ones open or spreading, most of the branchlets with 2–3 spikelets each; glumes equal or nearly so, acute or awl-pointed, 5–6″ long, purplish, equal to the flower or slightly longer; palet scabrous; awns sub-equal, middle ones about 8″, lateral ones 4–5″ long.—Cottonwood, Arizona, 1874 (348).

SPARTINA GRACILIS, Trin. (Watson's Botany 40th Parallel, Synopsis Flora of Colorado).—Nevada, 1871; Saguache, Colorado, 1873 (1111).

PLEURAPHIS JAMESII, Torr. (Watson's Botany 40th Parallel, Synopsis Flora of Colorado).—Arizona, 1871 and 1872; Santa Fé, N. Mex., 1874 (17); Agua Azul, N. Mex., 1874 (132).

BOUTELOUA CURTIPENDULA, Gr.—Arizona, 1871 and 1872; Camp Crittenden and Cienega, Arizona, 1874 (284, 586, 677).

BOUTELOUA GRACILIS, Hook.?—Low, 6–12′, densely cæspitose, much branched at the base; leaves short (1–2′), flat; spike with 6–10 slender spikelets, about ½′ long, nearly sessile, with two to three sterile flowers or bractlets, one perfect flower, and a rudiment which is 3-awned and longer than the perfect flower. This species is related to *B. curtipendula*, but much smaller and more delicate.—Riley's Well, Arizona, 1874 (701) [A sparse but good forage.—J. T. R.]

BOUTELOUA POLYSTACHYA, Benth.—Culms low, cæspitose (about 6–12′), smooth; leaves 1′ long, acute, ciliate at the top of the sheath; racemes numerous, graceful; spikes 3–5, subsessile, 4–6″ long, erect; spikelets ½ to ¾′ long; rachis compressed, margin minutely puberulent; flowers in two series on the rachis; glumes hyaline, lower one small, upper one with a short awn; palets 2-lobed, the lower with 3 awns, upper with 2, rudiments with 3 awns, which equal those of the flower.—Arizona, 1871 and 1872; Gila Valley, 1874 (770, 352).

BOUTELOUA POLYSTACHYA, VAR. MAJOR?—I use this name provisionally to designate a grass larger in all its parts than the preceding. Culms 1–1½° high; racemes with mostly 5–7 spikelets, which are about 1′ long, rather on one side of the culm, sessile or nearly so, about 1′ distant; culms somewhat branched below, rather leafy; leaves flat, 3–4′ long, scabrous on the margin. Probably this has been described as a distinct species.—Sanoita Valley, Arizona, 1874 (691, 347).

BOUTELOUA HUMBOLDTIANA, Griseb.?—Under this name I have placed specimens from New Mexico, because of their correspondence to Cuban specimens of that name in the Herbarium. I do not know where the description is given. The grass is about 1½° high, upper leaf very short; raceme 2–3′ long, of 4–6 spikes, each of which is about ½′ long, wide at the top, tapering below, of 4–6 long awned spikelets.—Camp Bowie, Arizona, 1874 (484).

BOUTELOUA JUNCIFOLIA, Lag.—Culms 1½–2° high, much branched below, leafy; leaves broadly linear-lanceolate, 4–6′ long, rather stiff, smooth panicle or raceme of 6–12 distant, rather coarse spikes, ½–¾′ long, each of 5–7 spikelets; glumes lanceolate, nearly as long as the perfect flower, acute, scabrous on the mid-nerve; lower flower perfect, upper ones staminate; lower palets of perfect flower tridentate, its terminal awn

little exceeding the palet, lower palet of sterile fl. with 3 long, coarse awns 3″ long (2024, Coll. C. Wright, N. Mex., 1851).—Camp Bowie, Arizona, 1874 (484 bis).

Bouteloua oligostachya, Torr.—Utah, 1871 and 1872. Twin Lakes, Colorado, 1873 (1113). Sulphur Springs, Arizona, 1874 (548).

Bouteloua hirsuta, Lag.—Chiricahua, Arizona, 1874 (512).

Bouteloua fœna, Torr.—Leaves glabrous; spikes 2–3, oblong, falcate, spreading; rachis nearly half the length of the spikes; upper glume nearly as long as the perfect flower, with two rows of piliferous glands on the back; lower palets deeply 3-cleft, the segments lanceolate and mucronate, hairy on the margin, neutral flower of two truncate emarginate valves, with a 2-valved rudiment of a third flower, and 3 short, stout awns (Torrey in Emory's Report).—Arizona, 1871 and 1872.

Chloris alba, Presl.—Spikes umbellate-fasciculate, numerous (8–12), the peduncle enclosed in a broad, compressed sheath; spikelets 2-flowered; upper glume nearly as long as the flowers, 2-toothed, with a short awn between the teeth; lower palet of the perfect flower obscurely 3-nerved, gibbous in the middle, the margin ciliate, with long hairs toward the summit; awn 3 times as long as the palets; neuter flower broad and truncate, enclosing a short aristiform rudiment (Torrey in Emory's Report).—Nevada and Arizona, 1871 and 1872. Cienega, Arizona, 1874 (578).

Buchloe dactyloides, Eng. (Synopsis Flora of Colorado).—Summit, Colorado, 1873 (1115)

Tricuspis pulchella, Torr.—A beautiful little grass, with densely cæspitose culms and few-flowered panicles, which are crowded among the fasciculate leafy branches (Torr.). Leaves plane, subulate rigid, scabrous; panicles subspicate, terminating the leafy branches; spikelets 6–7-flowered; glumes lanceolate, acuminate, smooth, equal; lower valve oblong, white-hairy along the middle and base, apex bifid, awned between the lobes; awn straight, exceeding the lobes; upper valve oblong, acute.—Arizona, 1871 and 1872. Cienega, Arizona, 1875 (575).

Graphephorum flexuosum, Thurb. (Synopsis of the Flora of Colorado).—Fort Garland, Colorado, 1873 (1116).

Kœleria cristata, Pers.—Chiricahua, Arizona, 1874 (516).

EATONIA OBTUSATA, Gr.—Utah, 1871 and 1872. Cave Spring, Arizona, 1874, and Zuñi (194).

MELICA MUTICA, Walt., var. GLABRA.—Sierra Blanca, Arizona, 1874 (805).

MELICA STRICTA, Bol. (Watson's Botany 40th Parallel).—Nevada, 1871 and 1872.

MELICA BULBOSA, Gey. (Synopsis Flora of Colorado).—Nevada, 1871 and 1872.

GLYCERIA NERVATA, Trin.—Twin Lakes, Colorado, 1873 (1121). Santa Fé, N. Mex., 1874 (71). A large form, Mount Graham, Arizona, 1874 (428).

GLYCERIA AIROIDES, Thurb. (Synopsis of Flora of Colorado).—Saguache Creek, Colorado, 1873 (1120).

GLYCERIA DISTANS, Wahl.—Santa Fé, N. Mex., 1874 (34).

BRIZOPYRUM SPICATUM, Hook., var STRICTUM, Gr.—Nevada and Utah, 1871 and 1872. Saguache Creek, Colorado, 1873 (1123 and 1124). Covero, N. Mex., 1874 (105). Alcadonis, N. Mex. (84).

CATABROSA AQUATICA, Beauv. (Synopsis Flora of Colorado, Watson's Botany 40th Parallel).—Near Gray's Peak, Colorado, 1873 (1122).

POA ALPINA, L.—Mosquito, Colorado, 1873 (1126). South Park, Colorado, 1873 (1127). This I take to be the true *alpina*, characterized by the short ovate panicle, and the broad, flat, thick and short, radical leaves.

POA ANDINA, Nutt.—Culms tufted, erect, rigid, smooth or scabrous, 6′ to 2° high, leafy at the base; leaves rigid, scabrous, flat or usually convolute, generally glaucous, cauline ones with very short or almost obsolete blades; panicle usually narrow, spike-like and close, or oblong and somewhat expanded, 2–5′ long; rays chiefly in threes, almost sessile, or short-stalked; spikelets about 3″ long, ovate, 3–5-flowered; glumes nearly equal, acute, about 2″ long, smooth, hyaline and (generally) purple-tinged, except on the keel, compressed, 1-nerved, or the upper indistinctly 3-nerved and broadest at the middle; flowers compressed and keeled, not webbed at the base; lower palet 2–2½″ long, obtuse or acutish, indistinctly or plainly 3-nerved; keel curved, scarious and generally purplish above, very light green below, smooth or softly puberulent, except on the keel and margins, which are more or less pubescent. This grass, which

is supposed to be the *Poa Andina* of Nuttall, is exceedingly variable and puzzling. It embraces several varieties, two of which are represented in this collection, viz: Var. SPICATA.—Radical leaves rigid, involute, scabrous, pungently pointed, 3 to 9′ long; panicle narrow and spike-like; branches sessile or nearly so.—Colorado, 1873 (1135, 1136, 1137). Var. MAJOR.—Panicle oblong; branches short; flowers larger and paler.—Arizona, 1872; Colorado, 1873 (1133, 1134).

POA TENUIFOLIA, Nutt. (Watson's Botany 40th Parallel, Synopsis Flora of Colorado).—This species presents a great variety of forms, some of which may yet require to be made distinct species. The general characters may be stated as follows: culms tufted, 1–2½° high, stout or slender, glabrous or with the leaves and sheaths more or less scabrous; leaves narrowly linear, 1–10′ long, ligule short or elongated; panicle erect or slightly bending, narrow or somewhat open and spreading, 2–6′ long; branches 2–5 together, scabrous, of unequal length; spikelets 2–5-flowered, glumes keeled, lanceolate or ovate-lanceolate, acute, scarious-margined, upper one 3-nerved, lower 1-nerved; flowers very narrow, linear or linear-lanceolate, scarcely keeled, convex on the back, obtuse or acutish, scarious, and bronze-tinged at the apex, puberulent or finely pubescent, obscurely nerved, not webbed; flowers readily separating at the joints. The grain is extensively gathered by the Indians for food. The following forms or varieties occur in the collection: Var. RIGIDA, Nevada, 1872, Colorado, 1873 (1138 and 1140); var. ELONGATA, panicle linear, 5–6 inches long; Nevada, 1872; Colorado, 1873 (1141).

POA PRATENSIS, L.—Colorado, 1873 (1125); Santa Fé, N. Mex., 1874 (19); and, what seems to be a slender form, in bogs, Twin Lakes, Colorado, 1873 (1131).

POA SEROTINA, Ehrh.—Twin Lakes, Colorado, 1873 (1130); also var. LAXICAULE, Twin Lakes, Colorado, 1873.

POA CÆSIA, Sm.?, var. RIGIDA.—Mosquito, Colorado, 1873 (1142); South Park, Colorado, 1873 (1143).

POA LAXA, Hænke?—Colorado, 1873 (1128). Var. MINOR, Hall's post-office, Colorado, 1873 (500, J. Wolf).

POA FLEXUOSA, var. OCCIDENTALIS.—Twin Lakes, Colorado, 1873

(1132). Culm 2–3°, erect, rather stout; culm-leaves broadly linear (3–5′ long, 3″ broad), gradually tapering to a point, rather scabrous; sheaths mostly smooth, shorter than the internodes; panicle 4–8′ long; rays 2–5 together, mostly in twos or threes, 2–3′ long, and capillary, smooth or slightly scabrous, diverging, flower-bearing mostly for the upper third; spikelets 3–5-flowered, light green, rather loose; glumes acute, thin, smooth, except slightly hispid on the keel, obscurely nerved; lower palet distinctly 3–5-nerved, slightly pubescent, rather more so on the keel and margin below, acutish.

Poa Wheeleri, Vasey.—Culms 1½–2 feet high; radical leaves rigid, involute and cuspidate-pointed, 5–10 inches long; culms from running root-stocks like *Poa brevifolia*, Muhl., and having a panicle like that with capillary branches in pairs; flowers acute, not webbed.—South Park, Colorado, 1873 (1131).—Plate XXVIII. Fig. 1. Natural size. 2. Spikelet, magnified 5 diameters. 3. Upper floret, with rudiment, magnified 7 diameters.

Poa arctica, R. Br.—Culms 1½–2° high, erect, slender, very smooth, as are the sheaths and leaves; leaves about 2 on the culm, 2–3′ long, narrow-linear; panicle 4–5′ long; rays simple or in pairs, capillary, lower ones 2–3′ long, rather distinct, spreading and reflexed with age, branched near the extremity with few spikelets; spikelets mostly 3-flowered; glumes broadly ovate, rather acute, purple-margined; flowers ovate, acute, obscurely 3–5-nerved, smooth, except pubescent on the keel and lateral nerves, slightly webbed.—Along mountain streams. Twin Lakes, Colorado (1144 and 1145).

Eragrostis Purshii, Bernh.?—Nevada, 1871 and 1872; Camp Lowell, Arizona, 1874 (1004).

Eragrostis pilosa, Beauv.—Saguache Creek, Colorado, 1873 (1146).

Eragrostis poæoides, var. megastachya, Beauv.—Ash Creek, Arizona, 1874 (305). Var. foliosa, Cienega Creek, Arizona, 1874 (591).

Festuca ovina, L.—Utah, 1871 and 1872; Colorado, 1873 (1149).

Festuca ovina, L., var. duriuscula.—Twin Lakes, Colorado, 1873 (1150).

Festuca ovina, L., var.—Mount Graham, Arizona, 1874 (424).

Festuca ovina, L., var. aristata.—South Park, Colorado, 1873 (1148).

FESTUCA OVINA, L., var. TENUIFOLIA.—South Park, Colorado, 1873 (1151).

FESTUCA OVINA, L., var. BREVIFOLIA, Watson.—Mount Lincoln, Colorado, 1873 (1152).

FESTUCA TENELLA, Willd.—Denver, Colorado, 1873 (1147); Santa Fé, N. Mex., 1874 (74).

FESTUCA THURBERI,* Vasey.—Culm 2–2½ feet high, erect, cæspitose, smooth, 2–4-leaved; leaves rigid, involute, 6′ long, scabrous; radical leaves numerous, involute, rigid, 1–1½° long, very scabrous on the margin, sheaths somewhat membranaceous; blade deciduous when old; panicle compound, 3–5′ long, a little drooping, of 4–5 nodes; branches or rays single or in pairs, slender, 2–4′ long, spreading when ripe, branching at or below the middle; spikelets purplish, oblong-lanceolate or cylindrical when young, broad above when expanded, 3–5-flowered, 5–6″ long, slightly scabrous under the lens; glumes thin, membranaceous, ⅓ shorter than the flowers, of nearly equal length (2″), obtuse or acutish, upper one convex, not compressed, obscurely nerved, lower one slightly keeled; flowers cylindrical, convex, not compressed; outer palet obscurely 5-nerved, 3″ long, lanceolate, acute or short cuspidate, minutely scabrous; inner palet narrow, slightly hispid on the keels, equalling the outer, sometimes bifid at the apex.

This species in several preceding collections from the Rocky Mountains has been called *Festuca scabrella*, Torr., but upon careful comparison of the figure and description of that species in Hooker's Fl. Bor. Am., I am satisfied that this is a different species.—Twin Lakes, Colorado, 1873 (1153); South Park, Colorado (1154).—PLATE XXIX. Natural size. Fig. 1. Spikelet, magnified 5 diameters. 2. Upper glume. 3. Lower glume 4. Upper palet. 5. Lower palet.

BROMUS CILIATUS, L., var. PURGANS?—Utah, 1871 and 1872; Twin Lakes, Colorado, 1873 (1155 and 1156); Sierra Blanca, Arizona, 1874 (802).

Var. MONTANUS.—Twin Lakes, Colorado, 1873 (1157); Mount Graham, Arizona, 1874 (435).

BROMUS BREVIARISTATUS, Thurb.? (Watson's Botany 40th Parallel).—

* [See, also, Botanical Gazette, vol. 2, No. 1.—J. T. R.]

Near Gray's Peak, Colorado, 1873 (1158). This differs somewhat from the plant described by Hooker, but is probably only a local variety.

PHRAGMITES COMMUNIS, L.—Utah, 1871 and 1872.

LEPTURUS PANICULATUS, Nutt.—Denver, Colorado, 1873 (1178); San Carlos Creek, Arizona, 1874 (777).

TRITICUM REPENS, L.—Nevada and Utah, 1871 and 1872; Twin Lakes, Colorado, 1873 (1166); Santa Fé, N. Mex., 1874 (35); Agua Azul, 1874 (103).

Var. TENERUM.—Cave Springs, Arizona, 1874 (195).

Var. GLAUCUM.—Cottonwood Creek, 1873 (1167).

Var. COMPACTUM.—Twin Lakes, Colorado, 1873 (1168 in part).

TRITICUM VIOLACEUM, Hornem.—Culms erect, 2°; leaves rather rigid, erect, inclined to be convolute; panicle erect, 4–5′ long; spikelets 3–5-flowered; glumes tapering into an awn longer than the body, 5–7-nerved; lower palet obscurely 5-nerved, with an awn longer than the palet, the upper one obtuse, ciliate on the margins; flowers more or less tinged. Perhaps only a form of T. CANINUM, L.—Twin Lakes, Colorado, 1873 (1168).

TRITICUM CANINUM, L.—Twin Lakes, Colorado, 1873 (1169).

HORDEUM JUBATUM, L.—Nevada and Utah, 1871 and 1872; Saguache, Colorado, 1873 (1164).

HORDEUM PRATENSE, Huds.—South Park, Colorado, 1873 (1165).

ELYMUS CANADENSIS, L.—Utah, 1871 and 1872; Rocky Cañon, Arizona, 1874 (297); Chiricahua, Arizona, 1874 (526).

ELYMUS SITANION, Schultz (Watson's Botany 40th Parallel, Synopsis Flora of Colorado).—Denver, Colorado, 1873 (1161); South Park, Colorado (1163); Twin Lakes, Colorado, 1873 (1162); Arizona, 1874.

ELYMUS CONDENSATUS, Presl (Watson's Botany 40th Parallel, Synopsis Flora of Colorado).—Nevada and Utah, 1871 and 1872; Grant Creek, Colorado 1873 (1160).

DANTHONIA SERICEA, Nutt.—Twin Lakes, Colorado, 1873 (1170); also a small form, which is perhaps D. SPICATA, South Park, Colorado, 1873 (1171).

TRISETUM SUBSPICATUM, Beauv.—North Pass, Colorado, 1873 (1172); Baker's Mine, Colorado, 1873 (1173).

TRISETUM ALPESTRE, Beauv.—This is chiefly distinguished from *T. subspicatum* by its slender, open, spreading panicle. It corresponds well with European specimens of *T. alpestre*.—Twin Lakes, Colorado, 1873 (1174).—PLATE XXVII. Fig. 4. Natural size. 5. Spikelet, magnified 6 diameters. 6. The same, with glumes removed. The figure should have shown a slight pubescence on the pedicel of the upper floret.

TRISETUM WOLFII.—Culms erect from a decumbent base, $1\frac{1}{2}$–2° high, smooth above; leaves flat, upper ones short, lower ones 4–6′ long, somewhat scabrous, ligule lacerate; flowers in an upright, close, almost spicate panicle, which is 2–4′ long, 1–2 rays at each joint; spikelets lanceolate, 2-flowered, and with rudiment or continuation of the rachis half as long as the upper flower, the rachis and filament villous; glumes lanceolate, membranaceous, acuminate, equalling the flowers, which have a few hairs at the base; lower palet lanceolate, acuminate, slightly split or 2-toothed at the apex, obscurely 5-nerved, bearing near the point a straight appressed awn, equalling or a little exceeding the palet; upper palet rather shorter; grain oblong-linear, nearly as long as the palets. This obscure grass was collected by Mr. E. Hall in the Rocky Mountains, and in his collection was mixed with *Poa tenuifolia;* it was also collected by the writer in 1868, on the expedition of Major Powell, and distributed as No. 693 in his collection. Very fine specimens were also collected in Middle Park, Colorado, in 1874, by Prof. G. H. French. It is at least very close to, if not identical with, *Graphephorum melicoides*, some specimens of which from Mount Kineo, Maine, show the short awn on the lower palet.—Twin Lakes, Colorado, 1873.—PLATE XXVII. Fig. 1. Natural size. 2. Spikelet, magnified 5 diameters. 3. A floret, showing the palets and the linear seed, enlarged 5 diameters.

AIRA CÆSPITOSA, L., var. MONTANA.—The Rocky Mountain forms of this species vary from the description in having involute instead of flat leaves, but rather thick and coarse, unlike the bristle-form leaves of *A. flexuosa*, and usually also in having longer awns than are described.—Utah, 1871 and 1872. South Park, Colorado, 1873 (1175). Willow Spring, Arizona, 1874 (230).

HIEROCHLOA BOREALIS, R. & S.—South Park, Colorado, 1873 (1176).

Beckmannia erucæformis, Host. (Watson's Botany of 40th Parallel, Synopsis Flora of Colorado).—Saguache Creek, Colorado, 1873 (1177). Zuñi, N. Mex., 1874 (163).

Panicum obtusum, H. B. K.—Culms erect, about 18′ high, rather rigid; leaves linear, rigid, 3–6′ long; sheaths smooth; panicle erect, 5–6′ long, of 5–7 appressed branches; spikelets in pairs, sub-imbricated, obovate, obtuse, smooth; inferior flower of 2 palets, triandrous; perfect flower narrow, longitudinally striate. Plant glabrous and somewhat glaucous. Rachis narrowly linear, very flexuous.—Sulphur Springs, Arizona, 1874 (549).

Panicum maximum, var. bulbosum, Jacq.—Root bulbous; culm erect, 3–4° high, rather wiry, naked above, glabrous; leaves narrowly linear, erect, 3–4′ long, smooth, or somewhat scabrous; panicle 3–6′ long, strict; rays mostly single, strict, distant, branched to the base, sparsely flowered; spikelets mostly sessile, or very short-peduncled, ovate, acutish; glumes thin, purplish, obtuse, the lower about half as long as the perfect flower, upper one 5-nerved; sterile flower of two thin palets; perfect flower ovate-oblong, smooth.—Rocky Cañon, Arizona, 1874 (296 and 298).

Panicum Crus-galli, L.—Camp Crittenden, Arizona, 1874 (668).

Panicum leucophæum, H. B. K. (*P. lachnanthum*, Torr.)—Culm ascending, branched below, glabrous, 1½–2° long; leaves flat, 4–6′ long; sheaths hairy; panicle oblong, erect, 3–6′, the branches alternate and loosely racemose; all the spikelets pedicellate, oblong; inferior glume very short, glabrous; the superior and the inferior palet of the abortive flower much attenuate and somewhat awned at the tip, densely covered with very long, white, silky hairs; perfect flower ovate-lanceolate, acuminate and mucronate, glabrous, finely striate, and dotted longitudinally.—Arizona, 1871 and 1872. Camp Bowie, Arizona, 1874 (489).

Setaria caudata, R. & S.—Culm erect, 2°, flattened below, leafy; leaves and sheaths retrorsely scabrous, flat, hairy at the mouth of the sheath, upper leaves involute-pointed; panicle cylindrical, 4–6′ long, dense or loose and interrupted, pale green; spikelets glomerate, oblong, acutish, 1″ long; glumes herbaceo-membranaceous, cordate, mucronulate, lower one ⅓ to ½ as long as the upper, upper one 5–7-nerved, perfect flowers ovate, acute, finely punctate; bristles upwardly serrulate,

4–6″ long.—Gila Valley, Arizona, 1874 (334). Var. PAUCIFLORA much smaller and more delicate; leaves broader and shorter and not scabrous; panicle much smaller and looser, is 2096, C. Wright, N. Mex. Coll., 1851 and 1852.

HELOPUS PUNCTATUS, Nees.—This differs from *Panicum* in having clavate, torulose pedicels, and in the absence of the inferior glume. Culm erect, 2–3° from a decumbent base, somewhat pubescent at the nodes, ligule a short pubescent fringe; leaves lanceolate-linear, 6–10′ long, 3–5″ wide, smooth; panicle 6′ long, of 5–10 erect, sessile branches; axis and rays pubescent; pedicels clavate, with a short ring-like torus; spikelets 1½–2″ long, acuminate, finely pubescent; glume and sterile flower pointed; perfect flower oval or oblong, mucronulate, punctate.—Cienega, Arizona, 1874 (583).

ANDROPOGON MACROURUS, Michx.—Southern Nevada and Arizona, 1871 and 1872.

ANDROPOGON ARGENTEUS, Ell.—Arizona, 1871 and 1872. Sulphur Springs, Arizona, 1874 (547).

ANDROPOGON SCOPARIUS, Michx.—Black River Flats, Arizona, 1874 (790).

ANDROPOGON CILIARIS, Trin. (*Elionurus ciliaris*, H. B. K.)—This belongs to a section of *Andropogon* which is distinguished by having the spikes solitary, lateral, and terminal. Root fibrous, red, aromatic; culms cæspitose, ascending or erect (3–4°), compressed; ligules short, ciliate; leaves narrowly linear or filiform-involute, glabrous, or pilose below; spikes 2–4′ long, jointed; male spikelet with a short, ciliate, margined pedicel; perfect spikelet sessile, the lower glume acutely bifid at the apex, white hairy externally.—Sanoita Valley, Arizona, 1874 (638).

ANDROPOGON CONTORTUS, L. (*Heteropogon hirsutus*, Pers.)—This belongs to the same section as the preceding. Culm erect, branching, 1–2°, 2-edged below; sheaths and nodes glabrous; ligule short, truncate, ciliate; leaves flat, sharp-pointed, scabrous; spikes solitary; rachis and pedicel of the fertile flowers hirsute; outer glume of male flower acute and pilose; awn long (3′).—Sanoita Valley, Arizona, 1874 (656).

SORGHUM NUTANS, Gr.—Sanoita Valley, Arizona, 1874 (689).

IMPERATA ARUNDINACEA, Cyrill.—Spikelets in pairs, one sessile, the other

pedicelled, all fertile, articulate at the base; glumes 2, membranaceous, subequal, awnless, externally covered with long silky hairs; inferior flower of 1 hyaline palet; superior flower perfect, of 2 minute, hyaline, awnless palets; stamens 2, styles 2, elongated; stigmas plumose; panicle contracted, spike-form, cylindrical; spikelets externally surrounded with long silky hairs; culm erect, 2–3°, and with the nodes and the leaves glaucescent and smooth; leaves linear, setaceo-acuminate (1° or more long, 2‴ wide), rigid; panicle elongated-cylindrical, 4–8′. — Nevada, 1871 and 1872; Sanoita Valley, 1874 (656).

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

FERNS OF THE SOUTHWEST:

AN ACCOUNT OF THE FERNS WHICH HAVE BEEN COLLECTED IN SO MUCH OF THE TERRITORY OF THE UNITED STATES OF AMERICA AS IS WEST OF THE 105th DEGREE OF W. LONGITUDE, AND SOUTH OF THE 40th DEGREE OF N. LATITUDE.

BY

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PREFACE.

In this account of the Ferns of the Southwest, it has been thought best to give not merely a report of such as have been collected by the Surveys under Lieutenant Wheeler, but, including these, to make a full report of all the Ferns discovered hitherto in the regions lying west of the 105th degree of west longitude and south of the 40th degree of north latitude. Since many of the species are described only in works which are inaccessible to most collectors and amateurs of Ferns, it seems desirable to give reasonably full descriptions of all the species and genera which are not found in Gray's Manual, and to even describe anew a few which are given in that work. The earliest knowledge of the Ferns of California was based on the collections of Adelbert von Chamisso, who visited San Francisco in October, 1816. The Ferns which he brought home were described by Prof. Georg Friedrich Kaulfuss in a little work called "ENUMERATIO FILICUM", published at Leipsic in 1824. Messrs. Lay and Collie, the botanists attached to Captain Beechey's voyage in H. M. S. Blossom, made collections near San Francisco and Monterey in 1827. Drs. J. S. Newberry, C. C. Parry, and J. M. Bigelow made some collections in 1850–1855, mostly about San Diego, though the latter also collected near the 35th parallel in 1853 and 1854, and Dr. Parry has continued his work in California and elsewhere to the present day. General Amos B. Eaton collected some Ferns in the neighborhood of Monte Diablo in 1855, and Professor Brewer botanized in many parts of the State in 1860–1864. Other persons who have collected Ferns more or less abundantly in California were Dr. A. Kellogg, Mr. Thomas Bridges, Prof. Henry N. Bolander, Messrs. Harford and Dunn, Mr. F. A. Miller, and Prof. Alphonso Wood, etc.; and recently good collections of Ferns have been received from Mr. J. G. Lemmon, Mrs. Ellwood Cooper, Dr. Edward Palmer, Mrs. Mary E. Pulsifer Ames, Mrs. R. M. Austin, Dr. Joseph T. Rothrock (of this Survey), Mr. Daniel Cleveland, and others. The Ferns of Arizona and New Mexico were first collected by the botanists of the Mexican Boundary Survey (Messrs. Parry, Bigelow, Wright, and

Schott), and more recently by Dr. Rothrock, upon this Survey, and by Mrs. Sumner, the wife of the commander of the United States forces at Camp Bowie. Dr. Edward Palmer and a few other persons have also sent Ferns from this region. In Western Texas and the eastern part of New Mexico, Mr. Charles Wright, Mr. August Fendler, and Mr. F. Lindheimer made large collections of plants, Ferns among them, between 1843 and 1852.

The Ferns of the mountains of Colorado have been collected by Dr. Parry and Messrs. Hall and Harbour in 1861–1864, by Dr. George Vasey in 1868, and by other botanists of the Interior Department Surveys, by Prof. John Wolf, expedition of 1873 of this Survey, and especially by Mr. Townshend S. Brandegee, who has resided several years at Cañon City, Colorado. Other parties have from time to time made small collections in the same region. The Ferns of Northern Nevada and Utah, just on the border of the region embraced in the following report, were collected by Mr. Sereno Watson, of Clarence King's Survey of the 40th parallel, and to a small extent in Utah by myself. From Southern Utah, Drs. Palmer and Parry have sent good collections.

From Southern Nevada very little in the way of Ferns has been received.

In order to extend the usefulness of this report, a few Ferns which occur either in Texas or in the extreme Northwest, outside of our assigned limits, and which are more or less likely to be found within them, are inserted in their proper places.

Several additional species have been received while I have been preparing this report, and it is very probable that still other species will be discovered in the future.

The genera *Scolopendrium*, *Camptosorus*, *Struthiopteris*, *Onoclea*, *Dicksonia*, *Schizæa*, *Lygodium*, and, most remarkable of all, *Osmunda*, have never, to my knowledge, been discovered in any part of the territory west of the Rocky Mountains.

DANIEL C. EATON.

New Haven, Conn., *Sept.* 22, 1877.

ORDER. FILICES.

SUBORDER. POLYPODIACEÆ.

TRIBE I. POLYPODIEÆ.

I. POLYPODIUM. Linn.

Polypodium vulgare, Linn.

Mountains of Colorado (*Hall and Harbour, Vasey*), and on rocks at the Twin Lakes, *Wolf.* Cottonwood Cañon, Wahsatch Mts., *Watson.* The Colorado plants are uniformly small as compared with the common eastern form, measuring from less than an inch up to three inches high, and proportionately narrow. The segments are small and numerous for the size of the plant. The Wahsatch specimens are rather larger, but narrow, and with very obtuse segments, much as in Oregon specimens. In British Columbia and Unalashka, the species nearly resumes its eastern character.

Var. **occidentale,** Hooker.

Frond ample; 6–10 inches long; segments long-pointed, sharply serrated towards the point; texture chartaceous.—Flor. Bor. Am. ii, p. 258.

From San Francisco and Benicia northwards, often growing on trees. This form of the species scarcely deserves to be separated as a variety, especially since nearly similar forms occur in Europe, and more rarely in the Atlantic States.

POLYPODIUM FALCATUM, Kellogg, Proc. Cal. Acad. i, p. 20, (*P. Glycyrrhiza*, D. C. Eaton, in Sill. Jour. July, 1856, p. 138), with larger and thinner fronds (12–15 inches long), the segments numerous (3–4 inches long), tapering from a broad base to a very slender point, sharply serrate, veins free, with mostly four veinlets, fruit-dots smallish, nearest the midrib, occurs outside of our limits, but may possibly be discovered within them.—Shoalwater Bay, Washington Territory, *J. G. Swan.* Port Orford, Oregon, *Gen. A. V. Kautz.* Usually on trees: considered a form of *P. vulgare* by Mr. Baker (Synopsis Filicum, p. 334).

Polypodium Californicum, Kaulfuss.

Rootstock creeping, chaffy with light-brown scales; stalks straw-colored when dry, fronds from ovate to oblong-lanceolate, pinnatifid to the midrib; segments numerous, mostly oblong-linear, the lower ones narrowed at the base and decurrent, the upper gradually smaller and closer placed, passing into the incised apex of the frond; texture papery-herbaceous; veinlets 4–6 to each vein, the lowest veinlet bearing an ovoid or elliptical fruit-dot, the upper ones anastomosing occasionally near the margin of the segment.—Enum. Fil p. 102. *P. intermedium*, Hooker & Arnott, Bot. Beechey, p. 405.

California, mostly near the coast, from San Diego and Guadalupe Island northward. Plant in general resembling *P. vulgare*, the fronds usually of ample size, 10–18 inches high, 3–5 inches broad. It

varies a good deal in outline, and in the shape of the segments, which are either obtuse or acute, entire or serrated. Plants found very near the sea have a somewhat thicker texture, more regularly anastomosing veinlets, and more elliptical fruit-dots, and correspond more closely with the character given by Kaulfuss. I was at one time disposed to think *P. Californicum* and *P. intermedium* distinct species, but on maturer study adopt the view of Hooker and Baker, that they are but one.

Polypodium Scouleri, Hooker & Greville.

Rootstock creeping, scaly; stalks pale-brown, stout; fronds very thick and coriaceous, fleshy when recent, broadly ovate, pinnatifid to the midrib; segments linear-oblong, obtuse, obscurely serrulate, the terminal one distinct and often the longest; veinlets anastomosing regularly and forming a single series of large areoles; fruit-dots very large, borne near the costule on the upper segments only, or towards the ends of the middle segments also.—Icon. Fil. t. 56. *P. carnosum*, Kellogg, Proc. Cal. Acad. ii, p. 88, fig. 24. *P. pachyphyllum*, D. C. Eaton in Amer. Jour. Sci. July, 1856, p. 138.

On trees and stumps, more rarely on the ground, from Guadalupe Island (*Dr. Palmer*) to the neighborhood of Mount Shasta and Crescent City (*Prof. Brewer*), and northward to British Columbia. By far the finest of all our *Polypodia;* the fronds sometimes stand over 2 feet high, fleshy, evergreen, and with the fruit-dots (or *sori*) one-fifth of an inch in diameter. When the chaff has fallen from the rootstocks, they are seen to be glaucous-white and finely rugose. Gen. A. V. Kautz (then a lieutenant) noticed it growing on Firs at Port Orford, Oregon, in 1855, at the height of 150 to 200 feet above the ground. It was originally described from very small specimens with 5–9 segments, but Prof. Brewer collected it with as many as 27 and 29.

II. GYMNOGRAMME. Desv.

Sori (fruit-dots) oblong or linear, following the course of the veinlets, and, like them, either simple, forked, pinnated, or variously anastomosing, without indusium.—A large and not very natural genus, the species with fronds mostly of moderate size, and of nearly every possible shape, many with a hairy or tomentose surface, and some with a very beautiful white or yellow powdery coating to the under surface. Only two species are known to occur in the United States.

Gymnogramme triangularis, Kaulfuss.

Stalks densely tufted, slender, blackish-brown, polished, 6–8 inches long; fronds deltoid or 5-angled, 2–5 inches long and nearly as broad, pinnate, the lower pair of pinnæ much the largest, triangular, bipinnatifid, the rest oblong or lanceolate, more or less pinnately lobed or incised; segments obtuse, crenated: lower surface coated with a yellow or white powder, upper

surface smooth or minutely granular; lines of fruit forking, bursting through the colored powder, and at length nearly obscuring it.—Enum Fil. p. 73; Hook. & Grev. Ic. Fil. t. 153; Hook. Fil. Exot. t. 10.

Common in California, and said to occur as far northward as Vancouver Island, and to reappear in Ecuador. The plant from New Mexico referred to in the Botany of Whipple's Expedition, p. 160, is probably *Notholæna Hookeri*, which bears a considerable resemblance to small specimens of the present species. Commonly called *California Gold-Fern*. The powder on the under surface of the frond is usually a clear sulphur-yellow, but varies from deep orange to a pure white. In Hooker's Herbarium are specimens from Nuttall, with three MS. names, *G. Oregona*, *G. viscosa*, and *G. pyramidata*.

Gymnogramme hispida, Mettenius.

Rootstocks creeping; stalks grayish, puberulent; fronds 5-angled, 1–3 inches long and broad, hispid above, tomentose beneath, chaffy like the rachis with minute linear scales, pinnate; lower pinnæ much the largest and unequally triangular, again pinnated; pinnæ and lower segments lobed or crenated; the lobes rounded and very obtuse, the basal ones adnate to the rachis or midrib, and forming an interrupted wing, alternating with the pinnæ; veins all free.—Kuhn in Linnæa, xxxvi, p. 72. *G. podophylla*, Hook. Sp. Fil v, p. 152, in part. *G. pedata*, Eaton in Robinson's Catalogue, not of Kaulfuss.

New Mexico (*C. Wright*, *Mrs. Sumner*), Arizona (*Clarence King*), and at the Chiricahua Mts., *Dr. Rothrock*.—This comes very near to *G. pedata*, Kaulfuss, with which I have heretofore confounded it; but it is sufficiently distinguished by the rounded segments, and especially by the decurrent basal lobes, which form an interrupted wing on the main and secondary rachises, much as in *Phegopteris polypodioides*.

III. NOTHOLÆNA. R. Brown.

Sori on the veins at or near their extremities, roundish or oblong, soon more or less confluent into a narrow marginal band, with no proper involucre, but sometimes covered at first by the inflexed edge of the frond. Veins always free. Fronds of small size, 1–3- or 4-pinnate, the under surface almost always either hairy, tomentose, chaffy, or pulveraceous.

A genus of less than forty species, most abundant in dry, rocky places from New Mexico to Chile, but two are Mediterranean, and a few occur in South Africa, Australia, etc. The genus borders closely on *Gymnogramme* on the one hand, and on the other is barely distinguishable from those species of *Cheilanthes* in which the involucre is not well developed.

**Frond minutely scaly beneath.*

Notholæna sinuata, Kaulfuss.

Rootstock short and thick, very chaffy with narrow rusty scales; fronds 6 inches to 2 feet high; narrow and rigid, simply pinnate; pinnæ

numerous, short-stalked, roundish or ovate, varying from nearly entire to pinnately lobed, the upper surface more or less sprinkled with stellate or pinnately divided white scales, the lower surface densely covered with ferruginous ovate scales, their margin paler or whitish and elegantly ciliated.—Enum. Fil. p. 135.

Texas to Arizona (*Wright, Dr. Seguin, Rothrock, etc.*) and southward to Chile. This Fern varies a good deal in size and in the shape of the pinnæ, and includes *N. lævis*, Mart. & Gal., and *N. pruinosa*, Fée. The scales of the frond are very beautiful objects for the lower powers of a good microscope.

***Frond hairy or tomentose beneath.*

Notholæna ferruginea, Hooker.

Rootstock creeping, covered with very narrow dark rigid scales; stalks tufted, blackish, or very dark brown, at first woolly; fronds 8–12 inches high, narrowly lanceolate, pinnate; pinnæ numerous, 4–7 lines long, ovate, rather obtuse, pinnatifid with 6–8 closely set little lobes on each side, hairy above, but with the green surface visible, beneath densely tomentose, the wool at first whitish, but becoming ferruginous; sporangia deep brown.—Second Cent. of Ferns, t. 52. *N. rufa*, Presl; D. C. Eaton in Botany of Mexican Boundary.

Western Texas and New Mexico, collected by the Botanists of the Mexican Boundary Survey. Sanoita Valley, Arizona, *Rothrock*. Found also throughout Mexico and as far south as Ecuador and Peru. In Chile it is replaced by the nearly allied *N. hypoleuca*, Kunze.

Notholæna Parryi, D. C. Eaton.

Rootstock short, inclined, laden with rather rigid narrow scales, which are fulvous, with a blackish midrib; stalks 2–4 inches high, dark brown, minutely striated, pubescent with whitish jointed spreading hairs; fronds as long as the stalks, oblong-lanceolate, tripinnate, lower pinnæ distant; ultimate segments crowded, roundish-obovate, about one line long, densely covered above with entangled white hairs, like those of the stalks, and beneath with a still heavier pale-brown tomentum; sporangia blackish, when ripe projecting beyond the margin of the segments.—Am. Naturalist, ix, p. 351.

Crevices of Basaltic rocks near St. George, Utah, *Drs. C. C. Parry and E. Palmer*. Mts. in desert of Arizona (*Dr. Palmer, May*, 1876), and at Marengo Pass, San Bernardino County, California, *Dr. Parry, Dec.* 1875. This has very much the habit and appearance of *Cheilanthes lanuginosa*, Nutt., but the absence of anything like an involucre makes it a true *Notholæna*, and the denser and coarser character of the pubescence will also serve to distinguish the present plant.

Notholæna Newberryi, D. C. Eaton.

Rootstock covered with very narrow dark bristly scales; stalks tufted, 3–5 inches long, slender, blackish-brown, when young woolly with a pale-ferruginous tomentum; fronds as long as the stalks, lanceolate-oblong, covered, most densely beneath, with a web of very fine entangled whitish hairs, tri—quadripinnate; ultimate segments roundish-obovate, very closely placed, $\frac{1}{3}$–$\frac{1}{2}$ a line broad, entire or slightly crenate; sporangia rather large, blackish, at length apparent in the mass of tomentum.—Bulletin of Torrey Club, iv, p. 12.

Near San Diego, California (*Dr. Newberry, Prof. Wood, Mr. Cleveland*). Temescal Range, *Prof. Brewer*. Guadalupe Island, *Dr. Palmer*. It comes very near to N. *Parryi*, but is more compound, has smaller ultimate divisions, and a decidedly finer and more matted covering.

****Frond beneath pulveraceous, or coated with a fine powder, either white, yellowish, or yellow.*

+*Fronds once pinnate, the pinnæ with sessile segments.*

Notholæna candida, Hooker.

Rootstock creeping; the scales narrow, rigid, and nearly black; stalks tufted, 3–6 inches long, wiry, black and shining; frond rather shorter than the stalk, deltoid-ovate in outline, pinnate; the lowest pair of pinnæ having the lowest inferior pinnules elongated and again pinnatifid, three or four next pairs of pinnæ somewhat distant and clearly separated, lanceolate, pinnatifid into slightly curved oblong segments; upper pinnæ like the segments of the middle ones; segments green above, white-pulveraceous beneath, except on the nearly or quite black midribs, the margin slightly revolute, but not covering the line of dark-brown sporangia—Sp. Fil. ii, p. 116, and v, p. 111. *N. sulphurea*, J. Smith, Botany of Voyage of the Herald, p. 233; Baker, Syn. Fil. p. 373.—*N. pulveracea*, Kunze; D. C. Eaton in Bot. of Mex. Boundary.

Western Texas and New Mexico, *C. Wright*, 820 *and* 2124, *Bigelow, Schott.* Colorado Desert, Arizona, *Parry.* Recently discovered in San Diego Co., California, by *Mr. D. Cleveland* and *Miss A. E. Burbeck.* It extends throughout Mexico and as far as Peru and Chile.—This Fern has many names besides those quoted above. It seems to have been first named *Pteris sulphurea* by Cavanilles, from a form with yellow powder, not rare in Central America, but as its eldest name in the genus *Notholæna* is Hooker's, I do not see the propriety of going back with Messrs. Smith and Baker to the name *sulphurea*.

Notholæna Hookeri.

Rootstock short, creeping, densely covered with rigid lanceolate dark-brown scales, with a strong midrib; stalks tufted, 4–8 inches high, reddish-brown, wiry, smooth and shining, the base only with a few ovate scales; frond 2–3 inches long and broad, almost regularly pentagonal, composed of three divisions; the middle one slightly stalked, rhomboid-ovate, pinnatifid into a few oblong toothed segments, of which the second pair is larger than the first; the side divisions sessile, deltoid, pinnatifid on the upper side, much as is the central division, but each bearing on the lower side a single very large pinnatifid basal segment, and above it smaller segments like those of the upper side; upper surface green, lower surface covered with a pale-yellow powder; sporangia sub-marginal; the edge of the frond slightly recurved.—*N. candida*, var. 5-*fido-palmata*, Hooker, Sp. Fil. v, p. 111. *N. cretacea*, D. C. Eaton in Botany of Mexican Boundary, and in Bulletin of the Torrey Botanical Club, iv, p. 18; not of Liebmann!

Western Texas to El Paso, *C. Wright*, 821. New Mexico, in several places, *Bigelow, Schott, Rothrock, Mrs. Sumner.* Not seen in California, for "La Cuesta" is in New Mexico. My own recently recovered notes on the North American Ferns of the Hookerian herbarium show that Liebmann's *N. cretacea* is a yellow-powdered form of *N. candida*, and Mr. Baker is doubtless right in referring *Cheilanthes Borsigiana*, Mettenius, to the same species. As Sir William Hooker has remarked in Species Filicum that the present is "probably a distinct species," I can not do better than to call it by his name, rejecting the inconvenient appellation under which he distinguished it as a variety. In general appearance it is much like small specimens of *Gymnogramme triangularis*. From *N. candida* it differs in several respects, most markedly perhaps in having the second pair of primary pinnæ or segments decidedly smaller than the third pair, whereas in the former this second pair is larger than the pair next above it.

Plate XXX represents a plant of ordinary size. Fig. 1, a scale of the rootstock, magnified six diameters; fig. 2, a scale from the base of the stalk; fig. 3, a segment of one of the pinnæ, showing the sporangia and the slightly recurved margin.

++ *Fronds 2–4 pinnate, the primary and secondary pinnæ distinctly stalked, ultimate divisions very small.*

Notholæna dealbata, Kunze.

Stalks densely tufted, wiry or capillary, nearly black, polished; rachis and all its branches very straight, capillary, black and shining; frond deltoid-ovate, 4-pinnate at the base, gradually simpler above; pinnæ mostly opposite; ultimate pinnules ½–1 line long, oval and entire, or some of them 3-lobed; upper surface green, under surface white-pulveraceous.—Am. Jour.

Science, July, 1848, p. 82, and Die Farrnkräuter, ii, p. 57, t. 204. *Cheilanthes dealbata*, Pursh.

From the Upper Missouri (*Pursh, Nuttall*) and Kansas, where it is rather common, "chiefly on the perpendicular faces of dry calcareous rocks, where it is sheltered by overhanging projections" (*Hall, Parry*), to New Mexico (*Mrs. Sumner*) and Arizona, *Parry, Rothrock*. I have also seen specimens said to have come from Texas. The Kansas specimens are very delicate, only 3–4 inches high, and correspond exactly with Kunze's figure, but those gathered in Sanoita Valley, Arizona, by Dr. Rothrock, are much taller (8–9 inches), and have a stout wiry stalk, looking much more like a transition towards *N. nivea*. They have, however, the frond fully quadripinnate, and the very minute segments of the present species.

Notholæna Fendleri, Kunze.

Rootstock short, thick, chaffy, with ferruginous scales; stalks densely tufted, dark-brown, polished, 3–5 inches long; rachis and all its branches similar, but flexuous and zigzag; frond broadly deltoid-ovate, 3–5 inches long, and nearly as broad, 4—or nearly—5-pinnate below, gradually simpler above; pinnæ alternate; ultimate pinnules oval or elliptical, 1–1½ lines long, simple or 3-lobed; upper surface green, often glandular or dotted with white; under surface white-pulveraceous.—Die Farrnk. ii, p. 87, t. 136.

Clefts of rocks, Colorado, New Mexico, and Arizona, *Fendler, Hall & Harbour, Brandegee, Parry, Wolf, Palmer*. A larger plant than the last, and easily distingnished from it by the zigzag and usually much entangled branches of the rachis.

* * * * *Frond naked beneath, pinnately compound.*

Notholæna tenera, Gillies.

Stalks tufted, brownish, smooth, and shining; fronds 3–4 inches long [larger in Chilian plants], ovate-pyramidal, 2–3-pinnate, sub-coriaceous; pinnæ mostly opposite, distant, the lower ones somewhat triangular; ultimate pinnules ovate, often sub-cordate, obtuse, scarcely 1 line long, smooth and naked on both surfaces; texture rather delicate.—Bot. Mag. t. 3055; Kunze, Die Farrnk. i, p. 44, t. 22; Hook. Sp. Fil. v, p. 112.

Crevices of perpendicular rocks. Southern Utah, *Dr. Parry, May*, 1874. Like the last two species, this is closely related to *N. nivea*, the principal difference in this case being in the absence of the white powder. It occurs, also, in Bolivia and in Chile. Specimens with simply pinnate fronds, and larger, roundish pinnules, were collected with the more compound form in Southern Utah by Dr. E. Palmer in 1877.

Tribe II. PTERIDEÆ.

IV. CHEILANTHES. Swartz.

§ 1. ADIANTOPSIS.

Involucres separate, one to each fertile veinlet.

Cheilanthes Californica, Mettenius.

Rootstock short, creeping, chaffy with narrow dark-brown scales; stalks densely tufted, dark-brown, glossy, 4–8 inches long; frond 4 inches long or less, broadly deltoid-ovate, smooth on both surfaces, delicately quadripinnatifid [*i. e.*, 4-pinnate, with all but the primary rachis narrowly winged]; lower pinnæ largest, triangular, more developed on the lower side; upper ones gradually smaller and simpler; ultimate pinnules lanceolate, very acute, incised or serrate, and when fruiting with usually separate, crescent-shaped, membranaceous involucres in the sinuses between the teeth, which also are often at length recurved.—Mett. über Cheilanthes, p. 44. *Hypolepis Californica*, Hook. Sp. Fil. ii, p. 71, t. 88. *Aspidotis Californica*, Nuttall, MS. in Herb. Hooker.

Moist shady cañons and ravines in the Coast ranges of California, received by me only from Santa Barbara and Los Angeles Counties, but probably of wider range. Sonora, Mexico, *Schott.* A very delicate and pretty Fern, and eagerly sought by collectors. Sir William Hooker placed it in the genus *Hypolepis*, a genus of large Ferns, which are utterly unlike this plant in habit, and are really much nearer to *Phegopteris* than to *Cheilanthes*. The involucres are lunulate, and of a different substance from the lobule, at the base of which they are placed, but as the sporangia ripen this lobule is frequently reflexed, so as to form a sort of second involucre.

§ 2. EUCHEILANTHES.

Involucres more or less confluent, usually extending over the apices of several veinlets, but not continuous all round the segment.

* *Segments of the frond smooth, or glandular only.*

Cheilanthes Wrightii, Hooker.

Stalks castaneous, slightly chaffy at the base, 1–2 inches high; frond herbaceous, 2–3 inches long, ovate-oblong, pinnate, with about five rather distant pairs of deltoid bipinnatifid pinnæ; secondary pinnæ oblong, more

or less incised; involucres sub-continuous or interrupted, scarcely altered from the texture of the frond.—Sp. Fil. ii, p. 87, t. 110.

Between Western Texas and New Mexico, *C. Wright*, Nos. 823 and 2128. Arizona, in several places, *Dr. Rothrock.* This Fern has a rather slender creeping scaly rootstock, and the stalks not crowded together. The dark color of the stalk and rachis extends along the midribs of the pinnæ for about half their length. The frond is nearly, if not quite, glabrous, and of a clear, bright-green color.

Cheilanthes viscida, Davenport, (n. sp.).

Stalks 3–5 inches high, wiry, blackish, shining, the base chaffy with narrow crisped bright-ferruginous scales; frond herbaceous, minutely glandular and everywhere viscid, 3–5 inches long, narrowly oblong in outline, pinnate with 4–6 distant pairs of nearly sessile deltoid bipinnatifid pinnæ 5–6 lines wide and long; segments toothed; the minute herbaceous teeth recurved, and each covering 1–3 sporangia.

Collected in 1876 by *Dr. Parry*, probably near San Bernardino, California. This slender Fern much resembles *C. Wrightii*, but has the fronds taller, more finely divided, and excessively viscid, and the involucre is represented only by the recurved teeth of the segments. Indeed, it might almost as properly be considered a *Notholæna*, but its apparent affinities are with *Cheilanthes Wrightii* and *tenuifolia*. I received specimens from Mr. Geo. E. Davenport, of Boston, with the MS. name here adopted.

Cheilanthes microphylla, Swartz.

Rootstock creeping, short; stalks clustered, dark-brown, glossy, but rusty-pubescent along the upper side, 4–6 inches long; frond as long as the stalks, ovate-lanceolate in outline, twice or even thrice pinnate; primary pinnæ numerous, lanceolate, the lowest ones usually largest and more deltoid; secondary ones oblong or deltoid-ovate, deeply incised, or again pinnate in large specimens; texture rather firm; both surfaces smooth or with a very scanty pubescence; involucres nearly unchanged from the texture of the frond, interrupted or subcontinuous.—Synopsis Filicum, p. 127; Hook. Sp Fil. ii, p. 84, t. 98; Hook. & Baker, Syn. Fil. p. 135.

A common Fern in the West Indies and from Mexico to Ecuador and Peru. Specimens which I must refer to this species were collected somewhere in New Mexico by the Botanists of the Mexican Boundary Survey. It occurs in Florida, and seems to have been collected also at the Hot Springs of Arkansas by *Dr. Engelmann.* (See Kunze, in Am. Jour. Science, 1848, p. 87.) The New Mexican specimen has a frond unusually broad at the base, nearly thrice pinnate, and comes nearer to the var. *Moritziana* than to the narrower and less compound forms.

Cheilanthes Alabamensis, Kunze.

Rootstock "creeping," clothed with very slender delicate bright-brown scales, which at the base of the polished black stalks pass into a scanty ferruginous wool; frond narrowly lanceolate, 2–8 inches long,

bipinnate; pinnæ very numerous, closely placed, ovate-lanceolate, ½–1½ inches long; the lowest pair not enlarged, but usually smaller than those next following; pinnules mostly triangular-oblong, rather acute, oftenest auriculate on the upper side at the base, or in larger fronds having several teeth or lobes on each side; texture rather firm, surfaces green and glabrous; involucres pale, membranaceous, interrupted only by the incising of the pinnules.—Amer. Jour. Sci. July, 1848, p. 87; Hook. Sp. Fil. ii, p. 89, t. 103; Fil. Exot. t. 90 (*admirable*). *Pteris Alabamensis*, Buckley, Am. Jour. Sci. 1843, p. 177. *Pellæa Alabamensis*, Baker Syn. Fil. p. 148.

Mouth of Rio Pecos, *Dr. Bigelow.* Lower Rio Grande, *Schott.* Alabama and Tennessee to the borders of Virginia. This pretty little Fern is more slender than *C. microphylla*, and has narrower and more acute pinnules and paler involucres, but is nevertheless so closely related to it that Sir William Hooker had grave doubts of its distinctness. In removing it to the genus *Pellæa*, Mr. Baker has certainly separated it from its nearest allies.

** *Frond somewhat hairy and glandular, but not tomentose.*

Cheilanthes leucopoda, Link.

Stalks 3–4 inches long, pale straw-color, stout for the size of the frond, chaffy at the base with soft narrow rusty scales; frond about 3 inches long, deltoid-ovate, at the base 4-pinnate, gradually simpler upwards, everywhere glandular-puberulent; lowest pair of pinnæ unequally deltoid-ovate; upper ones oblong; secondary ones oblong, short-stalked; ultimate ones divided into minute rounded lobules, which when fertile are strongly revolute, concealing the sporangia.—Fil. Sp. Hort. Berol. p. 66; Mettenius, über Cheilanthes, p. 30.

Uvalde Cañon, Rio Nueces, Texas, *Mrs. M. J. Young*, 1876. Also found in Mexico. Though not yet discovered within the limits assigned to the present work, I have thought best to include this species, as it is a very recent addition to the Ferns of the United States, and will, with very little doubt, be found before long in New Mexico or Arizona. From *C. viscosa*, Kaulf., under which it is mentioned in Species Filicum, it differs by having a stouter and very much paler stalk (nearly black in the other), and a rather smaller and more rigid frond. Its general shape and composition are much the same as in *C. Californica*, but the plant bears a lax glandular pubescence, and has rounded very obtuse ultimate segments. *C. viscosa* is attributed to New Mexico in Species Filicum, but I have never seen any specimens from that Territory. The above notes will serve to distinguish it, if collected.

Cheilanthes Cooperæ, D. C. Eaton.

Stalks densely tufted, variable in length, brownish, fragile, hairy, like the frond, with entangled or straightish nearly white articulated often gland-tipped hairs; frond 3–8 inches long, ovate-lanceolate, bipinnate; the

rather distant pinnæ oblong-ovate; pinnules roundish-ovate, crenate and incised; the ends of the lobules reflexed and forming herbaceous involucres; segments at length flat.—Bulletin of the Torrey Botanical Club, vi, p. 33.

Cañon 15 miles north of Santa Barbara, California (*Mrs. Ellwood Cooper*); Sierra Valley (*J. G. Lemmon*), and near San Bernardino, *Dr. Parry*. This has much the appearance of the eastern *C. vestita*, which ranges from New York to Kansas, but which has never been found west of the Rocky Mountains. In *C. vestita*, the hairs are always very acute, while in the present species they are usually tipped with a glandular and viscid enlargement. The rootstock appears to be short, and its scales are soft and of a deep ferruginous brown.

§ 3. PHYSAPTERIS.

Ultimate segments minute, rounded; involucre usually continuous all round the margin; fronds, in all our species, 2–3-pinnate, with the lower surface tomentose or scaly, the tomentum or scales at first white, often becoming tawny as the fronds mature.

**Frond tomentose beneath, but not scaly (except on the rachises in C. Eatoni).*

+ Upper surface naked or nearly so; frond rarely more than twice pinnate.

Cheilanthes gracillima, D. C. Eaton.

Rootstocks creeping, branched, and forming a dense entangled mass, scaly with narrow rigid dark-ferruginous chaff; stalks slender, dark chestnut-brown, glossy, 3–4 inches long; frond 1–4 inches long, linear-oblong, bipinnate; primary and secondary rachises bearing delicate narrow bright-brown scales, as do the stalks when young; pinnæ many pairs, crowded, 3–6 lines long, pinnately divided into about 9 closely placed oblong-oval ultimate pinnules, which are rounded and at first slightly webby above, soon smooth, $\frac{3}{4}$–1 line long, beneath heavily covered with pale-ferruginous matted wool; involucres yellowish-brown, formed of the continuously recurved margin.—Botany of Mexican Boundary, p. 234; Hooker & Baker, Syn. Fil. p. 139. *C. vestita*, Brackenridge, Ferns of U. S. Exploring Expedition, p. 91 (not of Swartz).

In rocky places, mostly at high elevations, 6000–8000 ft., from the Yosemite to Oregon. Sacramento Valley, *Brackenridge*. Mendocino Co., *Kellogg & Harford*. Near Pend d'Oreille River, British Columbia, *Lyall*. Readily distinguished from the other species of this section of the genus by the naked upper surface of the pinnules, and by the rarely more than bipinnate fronds. The Mendocino County specimens and those from Sacramento Valley exceed the common dimensions a little; and in these there is a slight tendency towards a thrice pinnate condition of the frond. Called "*Lace Fern*" by visitors to the Yosemite.

++ *Upper surface decidedly pubescent; frond thrice pinnate in well-developed plants.*

Cheilanthes lanuginosa, Nuttall.

Stalks densely tufted, slender, blackish or brown, at first clothed with spreading woolly hairs, at length nearly smooth; fronds 2–4 inches long, 1–1½ broad, ovate-lanceolate, tripinnate, or bipinnate with crenately pinnatifid pinnules [in small northern forms bipinnate only]; pinnæ from deltoid below passing to oblong-ovate above, the lowest distant, the others contiguous; ultimate pinnules minute, not more than ½ a line long and broad, or the terminal one slightly longer and more obovate, all very much crowded; upper surface scantily tomentose, lower surface densely matted with soft whitish-brown distinctly articulated flattened woolly hairs; involucres very narrow, formed of the unchanged herbaceous margin of the segments.—Nuttall, MS. in Herb. Hook., and Sp. Fil. ii, p. 99; D. C. Eaton in addenda to Gray's Manual, edition of 1863; Baker, Syn. Fil. p. 139. *C. vestita*, Hook. l. c. in part, not of Swartz. *C. lanosa*, Eaton in Botany of Mex. Boundary, but not *Nephrodium lanosum*, Michx. *C. gracilis*, Mettenius, über Cheil. p. 36. *Myriopteris gracilis*, Fée, Gen. Fil. p. 150, t. 29, fig. 6.

From Illinois (*Vasey*), Wisconsin (*Hale*), and at the eastern base of the Rocky Mountains in British America, near lat. 51° (*Bourgeau*), to Utah (*Watson, Parry, Palmer*), Colorado (*Brandegee*), and New Mexico, *C. Wright*, Nos. 818, 2125. Arizona, *Dr. Parry*, 1867. Nuttall's specimens were from Fort Independence, Missouri. A smaller Fern than either of the next two, but closely related to both. From *C. tomentosa* it differs by its much smaller proportions, and by the rounded, contiguous segments, which in the latter are more obovate, and are separated from each other by about half their own diameter. From *C. Eatoni*, the absence of narrow chaffy scales from the stalks and rachis, and the slenderer habit, distinguish it readily. As to the name, I may remark that Mettenius gives it thus: "*Ch. gracilis*, Riehl (ex Fée g. 150)." But Fée names the plant himself "*Myriopteris gracilis*, F." (p. 149), and gives as a synonym "*Cheilanthes vestita*, Riehl *non* Sw., n. 529"; so that Mettenius is in error in quoting Riehl as originator of the name *gracilis*. Nuttall's name having existed, for many years before the publication of any of these works, as a manuscript name in so public and accessible a place as Hooker's herbarium, and having been published by Hooker in 1851 as a synonym to *C. vestita*, not the true *C. vestita* however, I think it proper to retain it now, although I am aware that some writers prefer the name *C. gracilis*. They ought, however, to accredit this name to Mettenius, and not to Riehl.

Cheilanthes tomentosa, Link.

Rootstock short, branching; stalks tufted, 4–6 inches long, rather stout, deep chestnut-brown, covered with pale-brown woolly tomentum; frond 8–15 inches long, oblong-lanceolate, everywhere but especially beneath tomentose with slender brownish-white obscurely articulated hairs, tripin-

nate; primary and secondary pinnæ ovate-oblong; pinnules distinct, roundish-obovate, $\frac{1}{2}$–$\frac{3}{4}$ a line long, terminal ones twice larger; the reflexed narrow margin forming a continuous pale membranaceous involucre.—Hort. Berol. ii, p. 42, and Fil. Sp. Hort. Berol. p. 66; Gray, Manual, ed. 2, p. 592, etc.; Baker, Syn. Fil. p. 140. *C. Bradburii*, Hooker, Sp. Fil. ii, p. 97, t. 109, B.

North Carolina, chiefly on sandstone rocks in Buncombe Co. (*Gray, Canby, Bradley, etc.*), and in Eastern Tennessee. Manitou rocks, near Jefferson City, Missouri, *Bradbury*. Texas, *Lindheimer*, No. 743, *Drummond in Herb. Hook.!* It probably occurs in New Mexico, as it certainly does in Mexico, whence the plant was sent to the Royal Botanical Garden at Berlin many years ago. The Arizona plant under this name in the Botany of the Mexican Boundary is the next species. Some of Prof. Bradley's fine specimens are, with the stalks, nearly two feet high.

Cheilanthes Eatoni, Baker.

Stalks tufted, 3–8 inches long, brownish, wiry, covered, as is the rachis and its branches, with very narrow pale-ferruginous scales; frond 4–8 inches long, oblong-lanceolate, tripinnate; lower pinnæ rather distant, upper ones crowded, ovate-oblong; ultimate pinnules or segments contiguous, $\frac{1}{2}$ a line long, rounded, but narrowed at the base, the terminal ones often twice larger and more decidedly obovate; upper surface gray-tomentose, under surface with a heavy matted ferruginous tomentum; involucres very narrow, hidden by the tomentum.—Syn. Fil. p. 140. *C. tomentosa*, Hooker, Sp. Fil. ii, p. 96, in part, and t. 109, A.

Western Texas and New Mexico, *Wright*, 816, *Fendler*, 1016. Indian Territory, *Palmer*, 427. Colorado, near Cañon City, *Brandegee*. Along the Gila and Colorado Rivers, Arizona, *Collectors of Mexican Boundary Survey*. This species was distinguished from *C. tomentosa* many years ago by Sir William Hooker, who gave an excellent figure and description of each, but he unfortunately considered this one to be *C. tomentosa*, and the true *C. tomentosa* he regarded as an undescribed species. The narrow appressed scales of the stalks, etc., will serve to distinguish the present species from the last and from *C. lanuginosa*. In average stature it is midway between the two, and it is more rigid than either.

** *Frond covered beneath with imbricated scales, but not tomentose.*

Cheilanthes Fendleri, Hooker.

Rootstock creeping, slender, covered with bright-brown delicate lanceolate crisped scales; stalks 2–5 inches long, chaffy with minute slender scales; fronds ovate-lanceolate, 3–4 inches long, tripinnate; scales of the primary rachis like those of the stalk, but those of the secondary and ultimate rachises larger, broadly ovate, entire or nearly so, usually edged or tipped with white, imbricated and overlapping the very minute ($\frac{1}{4}$–$\frac{1}{3}$ line broad)

beaded and sub-globose ultimate segments; these are naked above, and beneath commonly bear at their centre a single broad scale; involucre formed of the much incurved margin.—Sp. Fil. ii, p. 103, t. 107, B.

Texas and New Mexico (*Fendler*, 1015, *Wright*, 2126), extending northward to the mountains of Colorado (*Hall & Harbour*, 691, *Brandegee*), and westward to Arizona (*Parry*, *Palmer*) and California (San Gabriel Mts., *Brewer*, and near San Bernardino, *Parry*). The scales are very conspicuous, at first white, but gradually becoming brown, the tint spreading from the point of attachment. They are considerably larger than the ultimate segments, and those I have examined seem to be entire, broadly ovate and decidedly acuminate. I find that apart from these scales the pinnules or segments are perfectly glabrous on the under side, thus distinguishing the species from small forms of *C. myriophylla*, with which it has occasionally been confused.

Cheilanthes Clevelandii, D. C. Eaton.

Rootstock creeping, covered with narrow rigid dark-brown scales; stalks scattered, 2–6 inches long, dark-brown, wiry, when young scaly, but at length nearly smooth; fronds of mature plants 4–6 inches long, ovate-lanceolate, tripinnate; smooth and green above, beneath deep fulvous-brown from the dense covering of closely imbricated ovate-acuminate elegantly ciliated scales growing on the ultimate segments as well as on the midribs and rachises; segments otherwise naked, nearly round, flattish, $\frac{1}{3}$–$\frac{1}{2}$ a line broad, the terminal ones larger, the margin narrowly recurved and unchanged in texture and color.—Bulletin of the Torrey Botanical Club, vi, p. 33.

Mountains near San Diego, *Mr. Daniel Cleveland.* Imperfect specimens of what seems to be the same thing were sent in 1875 from San Bernardino by *Dr. Parry.* The fronds average a little larger than those of *C. Fendleri*, and are similarly divided into innumerable minute rounded segments, either densely placed or rather lax, as in that species. The scales are only half as large as those of *C. Fendleri*, are made up of much more tortuous cells, are in the mature frond of a very deep but bright cinnamon-brown, and bear near the base or along the lower part a few very long ciliary projections, which are often curved upwards and visible from the upper surface of the frond. It may prove that this is only a form of *C. myriophylla*, but as the scales of the frond are smaller and very closely imbricated, it is perhaps best for the present to regard it as distinct.

* * * *Under surface of pinnules both tomentose and scaly.*

Cheilanthes myriophylla, Desvaux.

Rootstock very short, clothed with dark-brown narrow rigid scales; stalks tufted, 2–6 inches high, castaneous, wiry, covered with partly deciduous pale-brown narrow appressed scales and woolly hairs intermixed; frond 3–8 inches long, oblong-lanceolate, smooth and green or deciduously pilose above, beneath matted-tomentose and densely clothed with pale-brown or ferruginous narrowly ovate-lanceolate ciliated spreading scales,

those of the ultimate segments with long tortuous cilia; pinnæ deltoid-ovate, narrower upwards, crowded or sub-distant; ultimate segments minute (½ a line broad), crowded, roundish, innumerable; the unchanged margin much incurved.—"Desv. in Journal de Botanique, ii, p. 44, t 13 f. 1." Hooker, Sp. Fil. ii, p. 100, t 105, A. Hook. & Baker, Syn. Fil. p. 140. *C. elegans*, Desv. *C. paleacea*, Mart. & Gal.

Western America, from Mexico to Chile, and reported from India also. Arizona, *Mr. Clarence King*. California, Monte Diablo Range, *Prof. Brewer and Dr. Gibbons*. Rocks, near the Gould and Curry Mill, Nevada, *H. G. Bloomer*. San Diego, *Mr. Cleveland*. The specimens which I refer to this species I had formerly supposed to belong to *C. Fendleri*, but a closer examination shows that the scales of the frond are narrower, and not entire, and that the whole plant is more or less tomentose as well as chaffy. The Californian specimens and those from Nevada are much smaller than those commonly sent from Mexico and South America. *C. elegans*, Desv., was founded on a Chilian plant with more obovate-pyriform ultimate segments. It is maintained as distinct by Fourn.ier, and specimens agreeing pretty well with its characters have been collected, since this report was prepared, at Cajon Pass, California, by *Mr. William Stout*. But they seem to be also nearly inseparable from *C. Fendleri*.

Cheilanthes Lindheimeri, Hooker.

Rootstock slender, elongated, creeping, branched, chaffy with thinnish ovate rusty scales; stalks scattered, 4–7 inches high, blackish-brown, polished, wiry, at first bearing narrowly lanceolate delicate scales intermixed with woolly hairs; frond 3–5 inches long, ovate-lanceolate, 3–4-pinnate; pinnæ mostly close-set; ultimate segments roundish-pyriform, about ¼ a line long, very much crowded, the unchanged margin much incurved; upper surface of frond white-tomentose, lower surface very chaffy with pale or ferruginous scales, those of the midribs ciliate at the base, those of the ultimate segments more and more ciliate and passing into entangled tomentum.—Sp. Fil. ii, p. 101, t. 107, A.

Western Texas to New Mexico and Arizona, *Lindheimer*, No. 744; *Wright*, No. 817; *King, Rothrock, Palmer, etc.* Plant with a long and slender rootstock, by which, and by the white-tomentose upper surface of the frond, it is to be distinguished from *C. myriophylla*. The ultimate segments are much smaller than in that species, and are also much more compactly arranged.

CHEILANTHES VESTITA, Swartz, and C. ARGENTEA, Kunze, are the only other species of the genus attributed to the United States. The former ranges from New York to Northern Alabama, and westward to Kansas. The latter is a species of Northern Asia, which is said to have been collected in Alaska by *Steller*. *C. aspera*, Hooker, will be found described in the genus *Pellæa*, to which Mr. Baker has very properly referred it.

V. CRYPTOGRAMME. R. Brown.

Sporangia on the back or near the ends of the free veins, forming oblong or roundish sori, which are at length confluent and cover the back

of the pinnules; involucres continuous, formed of the membranaceous and somewhat altered margin of the pinnule, at first reflexed along the two sides and meeting at the midrib, at length opening out flat; rootstock short; stalks stramineous, tufted; fronds smooth, herbaceous, dimorphous; sterile ones on shorter stalks, tri—quadri-pinnatifid, with toothed or incised ovate or obovate segments; fertile ones long-stalked, less compound, with narrowly elliptical or oblong-linear pod-like segments.—*Allosorus*, Bernhardi, in part. The generic name was proposed in 1823 by Robert Brown, in Dr. Richardson's Appendix to Franklin's first journey, for our species, and with it he associated the European *Pteris crispa*, Linn. *Allosorus* of Bernhardi is a much older name, but the character assigned to it was exceedingly vague, and the species referred to it, if by Bernhardi's expression "alle *Adianta spuria* Sw." we are to understand the species of *Pteris* which Swartz placed in his section *Adiantoideæ*, are now scattered among half a dozen diverse genera. Presl's *Allosorus* is likewise worthless, being a most heterogeneous assemblage of unlike species. Since the true object of scientific nomenclature in botany is to clearly set forth natural affinities and distinctions, and not, as some would have it, to perpetuate antiquated obscurities, I am quite content to follow the great masters Robert Brown and Sir W. J. Hooker in using the name *Cryptogramme*, though the name *Allosorus* may perhaps be kept, as by Mr. Baker, for a section of *Pellæa*.

Cryptogramme acrostichoides, R. Brown.—*Cr. crispa, forma Americana*, Hook. Sp. Fil. ii, p. 130. *Allosorus acrostichoides*, Sprengel, Gray's Manual.

Usually in dense tufts among rocks, often at high elevations. Isle Royale, Lake Superior, and generally in the Rocky Mountains and the Sierra from Colorado and California northward to 56° or 60° north latitude (*Dr. Richardson*), and in the Aleutian Islands, where it has a more condensed habit (*Allosorus foveolatus*, Ruprecht). The American plant is considered a form of the European *C. crispa* by Sir W. J. Hooker and by Dr. Milde, and one occasionally sees specimens which would seem so intermediate in charater as to justify this disposition, but the American plant is decidedly more rigid and subcoriaceous than the other, has less compound fronds, less incised sterile segments, and longer and more linear fertile ones. In *C. crispa*, the sporangia occupy only the upper portion of the fertile veins, and in *C. acrostichoides* they descend nearly or quite to the midrib. Curiously enough, Dr. Milde makes *Pellæa gracilis* also a form of his *Allosorus crispus*.

VI. PELLÆA. Link.

§ 1. CHEILOPLECTON. Fée, Baker.

"Texture herbaceous or subcoriaceous, and veins clearly visible, the involucre broad, and in most of the species rolled over the sorus till full maturity."

Pellæa Breweri, D. C. Eaton.

Rootstock ascending, short, covered, like the bases of the densely tufted shining-brown very fragile stalks, with abundant narrow crisped fulvous chaff; fronds 2–6 inches high, simply pinnate, the pinnæ short-stalked, 6–8 pairs, membranaceous, mostly 2-parted, the upper segment larger; segments and upper pinnæ oblong-ovate, rather obtuse, in the fertile fronds narrower; involucre continuous, pale; veins repeatedly forked.—Proceedings of Amer. Acad. vi, p. 555; Botany of U. S. Geol. Expl. of 40th Parallel, p. 395, t. xxxx.

Common on exposed rocks in the higher cañons of the Sierra of California (*Brewer, Bolander,* No. 6243), and eastward to the Wahsatch, 7-9,000 feet altitude, *Watson, Eaton.* New Mexico (*Dr. Loew in Lieut. Wheeler's Expl.*), and near Loma in Southern Colorado, *Dr. Rothrock.* Stalks half a line thick, terete, very fragile, so that in dried specimens the fronds are commonly broken off. The chaff is very abundant, bright cinnamon-brown, and composed of exceedingly narrow linear scales, 3–4 lines long. The scanty specimens from Loma, near the headwaters of the Rio Grande, show one or two additional segments of the lower pinnæ, but the Californian plants have the lower 3–5 pairs of pinnæ unequally 2-parted, the uppermost 2–3 pairs entire. The nearest related species is *P. auriculata* of South Africa.

Pellæa gracilis, Hooker, Sp. Fil. ii, p. 138, t. 133, B; Gray's Manual, ed. 5, p. 660. *Pteris gracilis,* Michaux. *Allosorus gracilis,* Presl. *A. crispus,* var. *Stelleri,* Milde, Fil. Europæ et Atlantidis, p. 26. *Pteris Stelleri,* Gmelin.

Usually in clefts of damp and shaded Limerock cliffs. Ten-mile Cañon, near Breckinridge City, Colorado, *Brandegee.* Labrador to Pennsylvania and Wisconsin; also in Mantchooria, Siberia, Tibet, and the Himalayas.

§ 2. ALLOSORUS. Baker.

Texture coriaceous, the veins not evident, involucre conspicuous.

* *Pinnules or segments obtuse or barely acute, not apiculate.*

\+ *Frond pinnate or bipinnate, never thrice pinnate.*

Pellæa atropurpurea, Link.—Hooker, Sp. Fil. ii, p. 138; Gray's Manual, ed. 5, p. 660.

Rio Mimbres, New Mexico (*Dr. Bigelow*), and Arizona, *Dr. Parry.* From Vermont and Canada to the Rocky Mountains of British America, and southward to Tennessee and Indian Territory. It reappears in Chiapas, and Fée's *P. mucronata* from the Valley of Mexico is not distinguishable from common forms. The plant varies much in the form and number of its segments, and in having the stalk and rachis perfectly smooth (*P. glabella,* Mett. & Kuhn, in Linnæa, vol. 36, p. 87), or more or less rusty-puberulent.

Pellæa aspera, Baker.

Rootstock short, ascending, moderately chaffy with narrow scales; stalks slender, 2–3 inches long, black, but with a pale scurfy pubescence; frond oblong-lanceolate, 4–6 inches long, bipinnate; pinnæ and pinnules

deltoid-lanceolate or oblong, pinnules next the main rachis often lobed; all of them very rough on both surfaces, with short harsh simple or forked whitish hairs; involucres continuous, the edges crenate.—Syn. Fil. p. 148. *Cheilanthes aspera*, Hooker, Sp. Fil. ii, p. 111, t. cviii, A.

New Mexico and Western Texas, *Charles Wright.* This Fern is peculiar among our species of the genus in having a harsh scabrous surface. Hooker noticed that the margins of the fertile pinnæ are transversely waved, and that the often forked or tripartite hairs are most abundant on the top of these undulations. One specimen shows a rootstock as thick as a crow's quill, an inch or so in length, and branched near the growing end.

++ *Frond bi—tri—quadripinnate, ultimate segments oval or cordate.*

Pellæa andromedæfolia, Fée.

Rootstock slender, creeping, covered with narrow glossy scales; stalks scattered, erect, wiry, pale-brown, smooth and naked, except for the narrow chaff at the base, 2–12 inches long, about equalling the ovate usually tripinnate but sometimes 2–4-pinnate fronds; primary pinnæ rather distant, spreading; ultimate pinnules 2–5 lines long, petiolulate or sessile, oval, slightly cordate and emarginate, fleshy-coriaceous, the fertile ones often with the edges revolute to the midrib; veins numerous, parallel, and sometimes producing narrow ridges on the upper surface; involucres herbaceous, with a narrow whitish edge.—Genera Filicum, p. 129. *Pteris andromedæfolia*, Kaulfuss, Enumeratio Filicum, p. 188. *Allosorus andromedæfolius*, Kaulf. in Kunze, Analecta Pteridographiæ, p. 18, t. 11.

California, mostly in the Coast Ranges, but collected in the "mountains near Live Oak Creek" and one or two other places (in Arizona?) by the Botanists of the Mexican Boundary Commission. Mexico? Also in Chile, but the Chilian plant has been described as a distinct species (*P. myrtillifolia*, Mettenius & Kuhn) upon insufficient grounds. Kunze also reports a station in Cape Colony. The stalks are commonly very straight, the rachis rarely a little flexuose, and their color is said to be reddish-brown with a delicate bloom when fresh, though dried plants show a nearly straw-colored rachis. A pubescent form was noticed by Nuttall.

Pellæa pulchella, Fée.

Rootstock very short, stout, nearly erect; stalks densely clustered, 3–8 inches long, chaffy at the base with narrow crisped scales, nearly black and polished, as are the rachis and all its divisions; frond as long as the stalk, or longer, triangular-ovate in outline, quadripinnate below, less compound upwards; ultimate pinnules numerous, very small, 1–3 lines long, oval or commonly cordate-ovate, obtuse, distinctly stalked, coriaceous, smooth, the edges often very much rolled in; involucre herbaceous.—

Genera Filicum, p. 129. Hooker, Sp. Fil. ii, p. 150. *Allosorus pulchellus*, Martens & Galeotti, Fil. Mex. p. 47, t. 10, f. 1.

Western Texas and New Mexico, *C. Wright*, Nos. 824 and 2132. Mexico to Peru. The New Mexican plant has been separated from the more southern form by Mettenius and Kuhn under the name of *P. microphylla*, as having shorter, broader, flatter, and more cordate segments, but except for its smaller size and more delicate habit, I see no difference between it and specimens from the State of Chiapas in Southern Mexico. The almost or quite black stalks and rachises and the minute cordate-ovate pinnules abundantly distinguish this species from *P. andromedæfolius*.

***Pinnules mucronulate or decidedly acute.*

Pellæa ternifolia, Link.

Rootstock short, thick, densely chaffy, the scales narrow and dark-brown, with a blackish midrib; stalks crowded, nearly or quite black, with a purplish bloom when living, rigid, 2–6 inches long; frond as long or longer than the stalk, narrowly linear in outline; pinnæ usually 9–15 pairs, all but a few of the uppermost trifoliolate; segments commonly linear-obovate, slightly mucronate, coriaceous, somewhat glaucous beneath, green above, sessile, or the middle one indistinctly petiolulate, when fertile with the edges much rolled in; involucre broad, the edge only membranaceous—Fil. Hort. Berol. p. 59. Hooker & Baker, Syn. Fil. p. 148. *Pteris ternifolia*, Cavanilles, Hooker & Greville, Ic. Fil. t. 126.

From Mexico to Peru and in the Hawaiian Islands. I refer to this species with much hesitation a few little specimens gathered by Dr. Sutton Hayes among the headwaters of the Rio Colorado of Texas. They have only the simply trifoliolate pinnules of this species, but the segments are of the short-oval or roundish form more common in the next. Were *P. ternifolia* ever known to develop more than three segments to a pinna in countries where it is abundant, it would seem reasonable to consider the two following species only forms of it with more and more compound fronds, but in the present state of our knowledge of them it is perhaps best to keep them separate.

Pellæa Wrightiana, Hooker.

Rootstock short, thick, nodose, densely chaffy with very narrow dark-brown scales; stalks crowded, purplish-brown, polished, rigid, 4–6 inches long; frond about as long as the stalk, from lanceolate to triangular-ovate in outline, bipinnate; pinnæ nearly sessile, spreading; pinnules coriaceous, smooth, green above, slightly glaucous beneath, almost sessile, at most about six pairs; those of the sterile frond roundish-oval, 3–5 lines long, two-thirds as broad, rounded, or even subcordate at the base, the apex obtuse, but with a minute subulate semi-pellucid cartilaginous point or mucro; those of the fertile fronds rolled in to the midrib and therefore

very narrow, often longer than the others, and curved upwards, similarly mucronate.—*P. Wrightiana* and *P. longimucronata*, Hooker, Sp. Fil. ii, p. 142 and 143, t. cxv. *P. mucronata*, Baker, Syn. Fil. p. 148; D. C. Eaton, in Bot. of Mex. Boundary, p. 233, in part. *P. Weddelliana*, Fée, 8me Mém. p. 74!

Western Texas and Colorado to New Mexico and Arizona. Bolivia, *Weddell.* Not seen from California. This plant varies much in the number of pinnules to a pinna, the lower pinnæ having commonly five or six pairs of them, but sometimes only two pairs besides the odd or terminal one. This latter form is strictly Hooker's *P. Wrightiana*, and the least developed examples of it I do not know how to clearly distinguish from *P. ternifolia;* the form with more numerous segments is Hooker's *P. longimucronata.* Hooker describes this as well as the next species as having "tufted stipites springing from clustered bulb-like caudices or rhizomes, about the size of hazel-nuts"; and Fée notices a similar "souche bulbiforme écailleuse" in the Bolivian plant. This latter, of which its describer has favored me with a specimen, has precisely the frond and pinnules of the narrow form of *P. Wrightiana*, but the scales of the rootstock are of a lighter brown, and with a less developed dark midrib, but not destitute of it as he has described them. In all these plants, the scales of the rootstock, when very young, and those found on the stalk of the *growing* frond, are nearly white.

Pellæa Ornithopus, Hooker.

Rootstock and stalks as in the last species, though often stouter; fronds very rigid, a few inches to a foot long, broadly deltoid-lanceolate in outline, when fully developed tripinnate; primary pinnæ spreading or obliquely ascending, linear, the lower ones ¼ to ⅓ the length of the frond, bearing from a few up to 15 or 16 pairs of trifoliolate, but varying to simple or to pinnately 5–7-foliolate, pinnules, which are usually only 1½ to 2 lines long, coriaceous, slightly glaucous beneath, roundish-quadrate in the rare sterile fronds, and with the margins rolled in to the midrib in fertile fronds, minutely mucronate.—Sp. Fil. ii, p. 143, t. cxvi, A. *Allosorus mucronatus*, D. C. Eaton in Silliman's Journal, July, 1856 (*described from very small specimens from Monte Diablo*).

Var. **brachyptera,** Eaton.

Secondary rachises ascending, much shortened, giving the frond a narrower outline and a denser habit; the pinnules crowded, oblong-linear, simple or trifoliolate, varying according to drought or humidity from 1½ to 5 lines in length.—*Platyloma brachypterum* and *P. bellum*, T. Moore in The Gardeners' Chronicle, Feb. 1873, pp. 141 and 213, *ex char.*

Common throughout California from San Diego and Guadalupe Island (*Palmer*) to Mendocino County and Grass Valley, growing mostly on dry hillsides in tufts among rocks, exposed to a long summer's drought and to a scorching sun. This bears the same relation to *P. Wrightiana* which that plant does to *P. ternifolia*, having more decompound fronds and still smaller ultimate pinnules. Plants culti-

vated in conservatories in the Atlantic States have fronds generally less compound than those gathered on their native hillsides, and it is in these cultivated plants only that I find sterile fronds with the pinnules flattened out. Otherwise the pinnules are closely revolute, and when trifoliolate, as they almost always are in a state of nature, they strongly suggest the claws of a bird's foot, whence the specific name chosen by Hooker, a name which I have no wish to disturb through a technical claim of priority. *Platyloma brachypterum* of Moore answers well to a form collected in the Sierras by Bolander, by Mrs. Austin, and by Mrs. Pulsifer Ames, a form with minute pinnules when growing on exposed rocks, but with elongated ones in a plant wet with spray escaping from a neighboring flume. Moore's *P. bellum* seems to be the same as the smaller form of var. *brachyptera*, except that some of the measurements given in The Gardeners' Chronicle, and copied by Baker in the second edition of Synopsis Filicum (p. 477), are incompre-hensible, and probably incorrectly printed. *P. bellum* of Eastern conservatories is not Moore's plant, and is ordinary *P. Ornithopus* slightly modified by cultivation in a moister atmosphere.

Pellæa densa, Hooker.

Rootstocks rather slender, entangled, chaffy with nearly black narrow scales; stalks densely tufted, wiry, and very slender, dark chestnut-brown, dull or polished, 3–9 inches long; fronds ovate or triangular-oblong in outline, 1½–2½ inches long, densely tripinnate; segments 3–6 lines long, linear, nearly sessile, sharp-pointed or mucronate, in the fertile fronds entire, and having the margin narrowly recurved, and provided with a distinctly paler involucre, in the very rare sterile fronds broader and sharply serrated, especially towards the apices.—Sp. Fil. ii, p. 150, t. cxxv, B. *Onychium densum*, Brackenridge, Ferns of U. S. Exploring Exped. p. 120, t. 13, f. 2.

Sierras of California from the Yosemite to the Castle Mountains, *Brewer, Bolander, etc.* Oregon, Rogue River (*Brackenridge*), and near Port Orford, *Gen. A. T. Kautz.* Near Jackson's Lake, Wyoming Territory, *Hayden's Expedition.* A very distinct species, not in the least related to those just described. Brackenridge, who considered it an *Onychium*, noticed that the plant bears a close resemblance in habit to *Cryptogramme acrostichoides*, and Hooker remarks the same similarity. A thin cross-section of a segment shows the involucre to be a very delicate special organ, growing just within the proper margin of the segment.

§3. PLATYLOMA. J. Smith, Baker.

"Texture coriaceous, the veins usually hidden, the ultimate segments broad and flat, the involucre so narrow that it is soon hidden by the fruit."

Pellæa Bridgesii, Hooker.

Stalks 3–6 inches long, wiry, dark-brown, smooth and polished, many rising from a short, creeping rootstock, which is chaffy with very narrow scales; fronds as long as the stalks, simply pinnate; pinnæ 5–18 pairs, mainly opposite, nearly sessile, glaucous-green, coriaceous, sterile ones orbicular or obscurely cordate, 4-5 lines long, rarely larger, fertile ones a little narrower, commonly at first conduplicate, and so seemingly lunate; involucre narrow, formed of the whitish cartilaginous margin of the pinnæ,

soon flattened out, and exposing a very broad intramarginal band of sporangia.—Sp. Fil. ii, p. 238, t. cxlii, B.

Sierras of California, usually above the elevation of 6000 feet. Discovered by *Thomas Bridges*, and since collected by *Brewer* at Ebbett's Pass (8000–9000 feet elevation) and in Silver Valley on the Big-Tree road, and by *Brewer*, *Torrey*, *Bolander*, *etc.*, in the Yosemite. A curious Fern, very different from all other American species, and only to be compared to *P. rotundifolia* of New Zealand, which, however, has a shaggy-paleaceous stalk and rachis, Hooker noticed that the margins of the pinnæ have a narrow white cartilaginous edge, "but not incurved." But it is plainly incurved in very young specimens. The two sides of each fruiting pinna are at first folded together, hiding the sporangia, and then the pinna is moderately curved upwards, giving it a decidedly crescent-like shape.

Pellæa flexuosa, Link.

Rootstock creeping, rather slender, the scales narrow, rigid, brown, with a darker midrib; stalks reddish-straw-color, several inches long, passing into a more or less flexuous or zigzag rachis; fronds from a half to two or more feet long, ovate-oblong in outline, twice or the larger ones thrice pinnate; secondary and tertiary rachises usually deflected and zigzag, rusty-puberulent or nearly smooth; pinnæ mostly alternate; ultimate pinnules 5–10 lines long, roundish-ovate or sub-cordate, very obtuse, distinctly petiolulate, sub-coriaceous, smooth, slightly glaucous beneath, the margin of fertile pinnules at first reflected and partly covering the sporangia, at length flattened out.—Fil. Hort. Berol. p. 60. Hooker, Sp. Fil. ii, p. 149. *Allosorus flexuosus*, Kaulfuss, Kunze, die Farrnkräuter, p. 46, t. 23.

From Western Texas and New Mexico (*Wright*) to Arizona, Camp Crittenden, *Dr. Rothrock.* Mexico to Peru. This comes very near to *P. cordata*, J. Smith, and is united with it by Mr. Baker in Synopsis Filicum. The zigzag rachises and strongly deflected branches are a very marked feature, but this character is none too constant. Occasionally there are large-pinnuled plants of *P. andromedæfolia* also, which bear a considerable resemblance to the present species. In our territory it reaches its extreme northern limit, and the specimens are much smaller than those from Central America. Fournier, in the Cryptogamia of Mexico, keeps *P. cordata* and *P. flexuosa* apart, and Dr. Max Kuhn, in his publication of posthumous species of Mettenius, in Linnæa, vol. 36, has described our plant as a distinct species under the name of *P. intermedia.*

VII. PTERIS. Linn.

Pteris aquilina, Linn., *var.* **lanuginosa,** Hooker.

Frond silky-pubescent or tomentose, especially on the under surface; otherwise as in the typical eastern form.—Sp. Fil. ii, p. 196. *P. lanuginosa*, Bory in Willd. Sp. Pl. v, p. 403. Hook. & Arn. Bot. Beech. Voy. p. 405. Kaulf. Enum. Fil. p. 189.

Very common throughout California and Oregon, extending northward to Sitka and eastward to Utah. Farther east it passes into less pubescent forms and so into the common form of the Atlantic

States. In one form or another, the common Brake occurs in almost every region of the earth. In Oregon and Northern California, it forms thickets as high or higher than a man's head, and many acres in extent. The miners of California boil the young fronds, and eat them as a substitue for asparagus.

VIII. ADIANTUM. Linn.

Adiantum pedatum, Linn.

In moist, rocky places, from Santa Cruz, California, to Oregon and Washington Territory, and northward to Unalashka. Wahsatch Mts., Utah. Common in the Atlantic States from North Carolina to Canada. It also occurs in Japan and Mantchooria, but does not appear to have been found among the mountains of Colorado, where it might reasonably have been expected.

Adiantum Capillus-Veneris, Linn.

Stalks and rachises very slender, nearly black, polished; frond ovate-lanceolate in outline, very delicate, smooth, bipinnate or sub-tripinnate, the upper half or third simply pinnate; pinnules and upper pinnæ wedge-obovate or somewhat rhomboid, rather long-stalked, the sides nearly straight or moderately concave, the upper margin commonly rounded and more or less incised, crenated, or [in the plant of our district] acutely dentato-serrate, except where the margin is recurved to form the lunulate or transversely oblong separated involucres.—Sp. Pl. p. 1558. Hook. Sp. Fil. ii, p. 36; British Ferns, t. 41. D. C. Eaton in Chapman's Flora, p. 591.

About the mouth of springs and wells in Southern Utah; St. George (*Drs. Palmer and Parry*), Kanab, *Mrs. Thompson*. New Mexico (*C. Wright*, No. 2123), Camp Bowie, *Dr. Rothrock*. Damp cañons in Southern California (*G. W. Dunn*), near Santa Barbara (*Mrs. Cooper*), and at Cassitas Pass, *Dr. Rothrock*. Also from North Carolina and Florida to the Hot Springs of the Arkansas and Texas. Its range extends throughout a great portion of Europe, Asia, Africa, South America, and Oceanica.

Plant with a short, creeping rootstock, the stalks very delicate, 4–8 or 10 inches long, sometimes erect, but more frequently drooping or pendulous; frond 8–10 inches long, but in favored stations occasionally very much larger. The plant of the Gulf and Atlantic States is very similar to the European form, having the pinnules mostly sharply cuneate, often deeply lobed, and the upper or outer margin of the sterile pinnules crenated or obscurely toothed; but the plant of Utah, California, etc., differs in having the pinnules broader, firmer, less incised, and the outer margin, if sterile, very acutely and finely toothed, the veinlets even slightly produced into minute needle-points. In all these points it shows a slight approach to the following.

Adiantum emarginatum, Hooker.

Stalks and rachises rather stout, nearly black, polished; frond broadly ovate or deltoid-pyramidal, 2–3-pinnate, pinnules and upper pinnæ of ample size, rather long-petioled, smooth or nearly so, rounded or even reniform, the very base sub-cuneate, lower edges commonly a little concave, upper margin rounded, slightly incised; if sterile, acutely dentate, with the veins running to the points of the teeth; but when fruiting, with

2–5 transversely linear-oblong sub-continuous involucres.—Sp. Fil. ii, t. 75, A; not of Bory and Willdenow. Keyserling, Adiantum, p. 15, 37, No. 55. *A. Chilense*, Torrey in Botany of Parke's Survey, p. 21; Brackenridge, Ferns of U. S. Expl. Exped. p. 97; D. C. Eaton, Botany of Mexican Boundary, p. 233; and in Robinson's Catalogue of Ferns, not of Kaulfuss. *A. tenerum*, Torrey in Emory's Notes of a Military Reconnoissance from Fort Leavenworth to San Diego, p. 155. Newberry in Botany of Williamson's and Abbot's Survey, p. 93, not of Swartz.

From San Diego, California, northward to Oregon, common, but apparently not occurring east of the Coast Ranges. Stalks 6–12 inches long; frond about the same length, more than half as wide at the base, gradually narrower upwards, the pinnules ½–1½ inches broad, rounded, or the larger ones semicircular or almost reniform, bearing at first a few scattered hairs along the veins, soon quite smooth. The pinnules commonly have from one to four slight incisions on the rounded side. The very acute teeth of the sterile pinnules having the vein extending to the point of the teeth, and the transversely linear involucres, separate this from *A. Chilense*, with which I formerly confounded it, that species having the veins extending mostly to the notches between the teeth, and bearing more numerous lunulate involucres. The figure given by Hooker in Species Filicum is very characteristic of the common *Adiantum* of California, and does not represent any known plant of either Mauritius or Malacca. The specimen it was drawn from is marked in Hooker's herbarium "Malacca, Griffith." It is on the same sheet with a specimen more like a form of *A. Capillus-Veneris*, marked as coming from Delessert's herbarium, and collected in the Mauritius. Mr. Baker suggested a possible interchange or crossing of the tickets, an accident too common in all herbaria. Keyserling, who has apparently not seen the specimens, says that the *A. emarginatum* of Hooker's plate was "nach einem von B. Delessert hinterlassenen Exemplar, das vermuthlich aus Californien stammt." It is probably too late to trace with certainty the history and origin of the specimen figured, but it is enough that it accurately represents the Californian species, and none other. The original *A. emarginatum* of Bory and Willdenow was confessedly "very like the preceding [*A. Capillus-Veneris*], but constantly smaller, the pinnules always obcordate and never lobed." Keyserling refers this without hesitation to *A. Capillus-Veneris*, leaving the name free for the present species, for which it is not especially appropriate, though I do not think it is to be rejected on the score of utter unfitness.

Adiantum tricholepis, Fée.

"Frond oval in outline; stalk and rachis smooth, polished, deep-black; pinnules roundish, moderately long-petioled, hairy on both surfaces; sori very few, of unequal size; involucre very velvety; rootstock creeping, scaly, the scales linear, acuminate, tawny."—8me Mém. p. 72. Keyserling, Adiantum, p. 15, 37, No. 56. *A. Chilense*, var. *hirsutum*, Hook. Sp. Fil. ii, p. 43 (in part); D. C. Eaton in Bot. of Mexican Boundary, p. 233. *A. dilatatum*, Nutt. MS. in herb. Hook., and quoted in Sp. Fil. l. c. *A. pilosum*, D. C. Eaton in Robinson's Catalogue, but not of Fée, which is *A. Chilense*, var. *hirsutum*, Keyserl., from Chile.

In a rocky ravine near the mouth of the Rio Pecos, Western Texas, *Dr. Bigelow*. Monterey, California, *Nuttall*. Mexico and Yucatan. This belongs to the same group of species with the two last, a group characterized by having fronds of a pyramidal outline, twice to four times pinnate at the base, gradually

simpler upwards, the terminal segment with a rounded or obtuse outer margin, and the serratures of the sterile segments having a veinlet extending to the point (not to the sinus). The present species has both surfaces of the frond minutely pilose with appressed whitish hairs. The involucres are variable in shape, oblong and linear on the same pinnule, and rather few (3–7) in number. This is apparently a rare species, as I can not learn that it has been collected by any one in California since the time of Nuttall. It is No. 11 of Ervendberg's collection of Huasteca plants, and No. 687 of Schott's collection made in Yucatan in 1865.

Tribe III. ASPLENIEÆ.

IX. LOMARIA. Willd.

Sori in a continuous band next the midrib of the contracted pinnæ of the fertile frond, covered till mature by an elongated involucre, either formed of the recurved and altered margin of the pinnæ or else sub-marginal and parallel to the margin. Veins of the sterile frond oblique to the midrib, simple or forked and free. Fronds mostly elongated, pinnatifid or pinnate, in foreign species rarely undivided or bipinnate, of two kinds, the sterile foliaceous, the fertile commonly much contracted—A genus of about sixty species, finding its greatest development in the southern hemisphere. It is closely connected with *Blechnum*, which has the involucre remote from the margin, and the fertile frond not much contracted. The two genera were united by Dr. Mettenius, but it is more convenient to keep them apart.

Lomaria Spicant, Desvaux.

Rootstock short and thick, very chaffy; fronds tufted, erect; sterile ones nearly sessile or short-stalked, sub-coriaceous, narrowly linear-lanceolate, 8–24 inches long, 1–3 inches wide, tapering to both ends, pinnatifid to the rachis into very numerous close-set oblong or oblong-linear often upwardly-curved obtuse or apiculate segments, the lower ones gradually diminished to minute auricles; fertile fronds sometimes three feet high, long-stalked, pinnate; the pinnæ somewhat fewer and more distant, longer and much narrower than in the sterile frond, sessile by a suddenly widened base; involucres distinctly intramarginal.—"Desv. in Berl. Mag. v, p. 325." Hook. Sp. Fil. iii, p. 14. *Osmunda Spicant*, Linn. Sp. Pl. p. 1522. *Blechnum boreale*, Swartz, Syn. Fil. p. 115. Hook. British Ferns, t. 40.

From Mendocino County, California (*Bolander*) and near Crescent City (*Brewer*) to Oregon, British Columbia, and Sitka. It therefore hardly comes within the geographical range adopted for this report, but is still likely to be found to the south of the 40th parallel in the Coast Ranges of California. It is not an uncommon Fern throughout Europe, and a form of it has been collected in Japan. The North American plant was made a var. *elongata* by Sir W. J. Hooker in the Species Filicum, but the smaller European form has been collected near Astoria, Oregon, by Prof. Wood, and the large specimens from the

Coast Ranges differ from the type mainly in their greater size and luxuriance. *Blechnum doodioides*, Hooker, Sp. Fil. iii, p. 60, t. 153, seems to be, as Mr. Baker remarks, a form of the present plant with interrupted involucres, as in the related genus *Doodya*.

X. WOODWARDIA. Smith.

Woodwardia radicans, Smith, *var.* **Americana,** Hooker.

Caudex stout, very chaffy with large scales, assurgent or erect, and rising a little above ground; stalks strong, 8–12 inches long; fronds standing 3–5 feet high, subcoriaceous, pinnate; pinnæ 8–15 inches long, 2–4 inches broad, oblique to the rachis, pinnatifid nearly to the midrib; segments triangular-lanceolate, slightly falcate, acuminate, spinulose-serrate or in large plants more or less pinnatifid; veinlets forming a single row of oblong sorus-bearing areoles each side of and next to the midvein, besides a few oblique empty areoles outside the fruiting ones, thence free to the margin; sori oblong, often slightly curved, the sporangia resting in the hollowed areole, and at first covered by an arched and convex indusium.—Hooker, Sp. Fil. iii, p. 67. *W. spinulosa*, Martens & Galeotti, Fil. Mex. p. 64. *W. Chamissoi*, Brackenridge, Ferns of U. S. Expl. Exped. p. 138.

From Long Valley to Southern California. Mexico to Chiapas and Guatemala. One of the largest and coarsest of Californian Ferns, apparently not uncommon. The type (*W. radicans*, Smith, Mem. Acad. Turin, v, p. 412) is found in Madeira and along the Mediterranean countries; also in Northern India and the island of Java. The American plant differs mainly in the absence of a chaffy proliferous bud, which is commonly seen on the rachis near the apex of the frond in the old-world plant. It is also more decidedly spinulose-serrate, and the areoles of the venation are perhaps less abundant. It is worth the while of Californian Botanists to observe whether their plant is *always* destitute of the proliferous bud.

XI. ASPLENIUM. Linn.

§ 1. ASPLENIUM.

Indusia straight, confined to the upper or inner side of the fertile veinlet.

Asplenium Trichomanes, Linn.

This common Eastern Fern occurs sparingly from the mountains of Colorado to the Pacific coast. On the brink of the Great Cañon of the Arkansas, *Brandegee*. Middle Mts., Colorado, *Hall & Harbour*, n. 692. Monte Diablo, California, *General Eaton*. Oregon, *Prof. Wood, E. Hall*. Cascades of Washington Territory, *Kellogg & Harford*, n. 1177. The *A. ebeneum* of the Flora of Colorado is this species.

Var. **incisum,** Moore, Nature Printed Ferns of Great Britain, t. 39, D.

This has the pinnules a little larger and more or less incised. It occurs fertile near San Diego (*Dr. Newberry, Mr. Cleveland*), and has also been collected in Vermont by *Mr. C. C. Frost*.

Asplenium parvulum, Martens & Galeotti.

Fronds tufted, erect, rigid, 4–10 inches high, narrowly linear-oblanceolate in outline, short-stalked, pinnate; stalk and rachis black and shin-

ing; pinnæ very numerous, 2–6 lines long, oblong, obtuse, entire or crenulate, auricled on the upper side at the nearly or quite sessile base, the middle ones longest, the lower ones gradually shorter, more distinct and deflexed; texture rigid-chartaceous; sori short, abundant.—Fil. Mex. p. 60, t. 15, f. 3. *A. trichomanoides*, Mettenius, über Asplenium, p. 137, not of Michx., Fl. Bor. Am. ii, p. 265. *A. resiliens*, Kunze, Linnæa, 18, p. 331. *A. ebeneum*, var. *minus*, Hook. Sp. Fil. iii, p. 139. *A. ebeneum*, D. C. Eaton in Botany of Mex. Boundary, p. 235.

Great Cañon of the Rio Grande, *Parry*. Texas, *E. Hall*, n. 852. Limestone rocks in shady places, Northern Alabama and Georgia, *Hon. T. M. Peters, Dr. Chapman*. Mexico to Chiapas.

This is perhaps not sufficiently distinct from *A. ebeneum*, which it replaces in the dryer regions of the Southwest and Mexico. It is a smaller and more rigid plant, with the pinnæ more entire, and more generally deflexed. Specimens from Chiapas have all the pinnæ deflexed. Michaux's Tennessee specimens of his *A. trichomanoides* I examined several years ago in Paris, and made a note that they clearly belong to *A. ebeneum*.

Asplenium septentrionale, Hoffmann.

Plant low, growing in dense tufts; rootstocks matted together, hidden by the blackened remains of old stalks; fronds crowded, 2–4 inches high, the slender naked stalk bearing an irregularly forking frond, consisting of from two to five narrowly linear rather rigid acute segments or branches, which are entire or more frequently cleft at the end into a few long narrow teeth; sori much elongated, placed near the margin, usually facing each other in pairs, commonly only two or three to each segment.—"Deutschl. Fl. ii, p. 12." Hooker, British Ferns, t. 26. D. C. Eaton in Botany of Mexican Boundary, p. 235.

On Ben Moore, New Mexico (*Dr. Bigelow*), and at perhaps the same station, *C. Wright*. Middle Mts., Colorado (*Hall & Harbour*, 689), and on the brink of the Great Cañon of the Arkansas, in company with *Aspl. Trichomanes, Brandegee*. In mountainous regions throughout Europe and in Northern India.

A very curious little Fern, originally described as an *Acrostichum* by Linnæus, referred to *Acropteris* by Link, and made the type of a genus (*Anesium*) by Newman. But it is no doubt better to regard it as an *Asplenium* with very narrow segments, and exceedingly elongated sori. The involucres, being very close to the margins of the segments, give the plant something of the look of a *Pteris*. Occasionally the segments are a little broader, and produce as many as four or five sori, and then the Asplenioid character is very evident.

§ 2. ATHYRIUM.

Indusia more or less curved, and often crossing to the outer or lower side of the fruiting veinlet.

Asplenium Filix-fœmina, Bernhardi, in Schraders N. Journ. Bot. 1806, pt. ii, p. 26, 48, t. 2, f. 7. Gray, Manual. Hooker, Sp. Fil. iii, p. 217.

North Temperate Zone generally, existing in a great variety of forms, and in some perhaps doubtful forms in Africa and South America. *Moore* separates the greater part of the North American forms specifically under the name of *Athyrium asplenoides*, Desv., making two varieties, one with broader and one with narrower pinnules; but the distinctive character which he relies mainly upon, the "creeping caudex," seems to be invalid, as our American plants grow in crowns no less decidedly than those of Europe. Having regard to only characters evident in ordinary herbarium specimens, I should arrange the North American forms which exist in my collection in five groups or varieties, as follows:

Var. **exile.**

Fronds 3–6 inches high, lanceolate, pinnate; pinnæ oblong-lanceolate, deeply cut into oblong laciniæ, which are 2–3 toothed at the end.

Maine (*Prof. O. D. Allen*). Chocorua, New Hampshire, *Minot Pratt.* A starved form, which undoubtedly will be found in many exposed and mountainous places.

Var. **angustum.**

Fronds 1–3 feet high, rather rigid, narrow in outline, nearly bipinnate; pinnæ obliquely ascending or curved upwards, narrowly lanceolate; segments oblong, crowded, crenated or serrate; sori usually abundant, straight or curved.—*Aspidium angustum*, Willd. *Aspl. Filix-fœmina*, var. *Michauxii*, Mettenius. D. C. Eaton in Botany of 40th Parallel, p. 396. *Athyrium asplenioides*, var. *angustum*, Moore, Index Fil p. 179.

Common in New England and Middle States in dryish and sunny localities. Sacramento Valley, (*Brewer*, No. 1437). Wahsatch Mts., Utah, *Watson, Eaton.*

Var. **latifolium,** Hooker.

Frond 2–3 feet high, oblong-lanceolate in outline, nearly bipinnate; pinnæ 3–4 inches long, oblong-linear, having a narrowly winged secondary rachis; pinnules broadly ovate and foliaceous, obtuse, simply or doubly serrate; sori nearer the midvein than the margin, indusia straight or curved, the basal ones often hippocrepiform (horseshoe-shaped).—Sp. Fil. iii, p. 218. *Athyrium Filix-fœmina*, var. *latifolium*, Moore, Nat. Print. Ferns, t. 31, f. B.(?)

An uncommon form. Port Orford, Oregon, *Gen. Kautz.* Oregon, *E. Hall*, No. 683. Near Philadelphia, Penn., *F. Bourquin*, 1867. I am not satisfied that this is exactly Moore's plant, and indeed the pinnules of the Oregon specimens are less imbricated than those he figures, while in the Philadelphia specimen they are for the most part quite distinct, but on the whole his plate well represents the form now before me.

Var. **commune.**

Frond ample, delicate, 2–4 feet high, broadly oblong-ovate, twice pinnate; pinnæ elongated (4–6–8 inches long); pinnules oblong-lanceolate, pointed, more or less pinnately incised and serrate, distinct or confluent on the secondary rachis by a very narrow and inconspicuous margin; sori short; indusium straight or variously curved.—*Aspl. Filix-fœmina* of most authors.

Eastern America, common in moist, shaded woods. Mount Graham, Arizona, *Rothrock.* California, *Brewer, Bolander, Kellogg, etc.* Ruby Valley, Nevada, *Watson.* Southern Utah, *Palmer.*

The ordinary, fully developed form of the species, which I am unable to separate from the common European plant. Moore's plate of *Ath. Filix-fœmina*, var. *ovatum* (t. 32), well represents an ordinary average specimen. In living plants, the stalk and rachis is often of a beautiful brownish pink, but this color is lost when the frond is dried for preservation.

Var. **cyclosorum,** Ruprecht.

Fronds very large, often 5 feet high and 18–20 inches broad; the pinnules often an inch long, oblong-lanceolate, pinnatifidly incised, or nearly again pinnated; sori roundish; indusium very short.—Distrib. Crypt. Vasc. Ross. p. 41. *Athyrium Filix-fœmina*, var. *incisum*, Moore, Nat. Pr. Brit Ferns, t. 30; var. *cyclosorum*, Moore, Index Fil. p. 183.

Oregon City (*Harford*). Port Orford, Oregon, *Gen. Kautz.* Vermont, *C. C. Frost.*

The largest form of the species, occurring on the west coast from Oregon to Alaska, rarer in the Atlantic States, and given by Moore as growing in Great Britain, France and Lapland. Var. *Sitchense* of Rúprecht, l. c., is probably the same thing. The crested, multifid, and irregularly developed forms of the Lady Fern are comparatively rare in America, but it is not to be doubted that diligent search would bring them to the light. One of them, var. *laciniatum*, Moore, is mentioned by Mr. Davenport as occuring in New Jersey. (See *Bulletin of Torrey Club, vol. vi, p.* 168.) Of the varieties above described, var. *latifolium* is the most distinct, but all are closely connected by various intermediate conditions.

Tribe IV. ASPIDIEÆ.

XII. PHEGOPTERIS. Fée.

Phegopteris alpestris, Mettenius.

Rootstock short and thick, erect or oblique; stalks 4–10 inches long, bearing a few large brown spreading scales near the base; fronds oblong-lanceolate, 1–2 feet long, pinnate with delicately bipinnatifid deltoid-lanceolate pinnæ, the lower pinnæ distant and decreasing moderately; pinnules ovate-oblong or oblong-lanceolate, incised and toothed; sori small, rounded, sub-marginal.—Fil. Hort. Lips. p. 83; über Phegopteris, p. 10. *Aspidium alpestre*, Swartz. *Polypodium alpestre*, Hoppe. Hooker, British Ferns, t. 6.

Among rocks at high elevations on Lassen's Peak, Mt. Shasta, and Pyramid Peak, and at other high points in the Sierras of California, *Brewer*, *Lemmon*. Cascade Mts. of British Columbia, *Dr. Lyall*. A Fern growing in large and dense patches, and much resembling narrow, delicate forms of the Lady Fern, but with globose sori near the margin of the lobes of the pinnæ, and without special proper indusium, for the objects figured as indusia by Mettenius in his later work on Asplenium are too delicate and fugitive to deserve the name. A common species in Northern Europe, but there the plant has usually broader segments than are found in the American specimens. The Eastern species, *P. polypodioides* and *P. hexagonoptera*, do not, to my knowledge, occur in the Southwest or in the Pacific States. *P. Dryopteris*, however, has been collected in Oregon.

XIII. ASPIDIUM. Swartz.

§ 1. DRYOPTERIS or NEPHRODIUM.

Indusium round-reniform, or orbicular with a narrow sinus.

* *Texture thin-membranaceous, veins simple or once forked.*

Aspidium Nevadense, (n. sp.).

Rootstock creeping, densely covered with the persistent bases of former stalks; fronds standing in a crown, thin-membranaceous, 1½–3 feet high, lanceolate in outline, pinnate; pinnæ linear-lanceolate from a broad base, deeply pinnatifid; the lower pairs distant and gradually reduced to mere auricles; lobes crowded, oblong, entire or sparingly toothed, slightly hairy on the veins beneath, and sprinkled with minute resinous particles; veins about seven pairs to a lobe, simple or forking; sori close to the margin; indusium minute, reniform, furnished with a few dark-colored marginal glands, and bearing several long straight jointed hairs on the upper surface.

Moist and shady places along creeks. Butte Co., California (*Mrs. Pulsifer Ames*), and in similar places in Plumas Co., *Mrs. R. M. Austin* and *Mrs. Ames*. The first specimens received were referred to *A. Noveboracense*, to which species there is the closest resemblance in the size, shape, and texture of the fronds, but later and more complete specimens have a rootstock of a very different character. The Central American *A. conterminum* is more like the present species in some of its characters, but that has much firmer fronds and an erect rootstock. *Aspidium Nevadense* of Boissier (a Spanish Fern) having been proved to be identical with *A. rigidum*, var. *pallidum*, there is no reason why the name should not be taken for a Fern coming from the Sierra Nevada of California.

Aspidium patens, Swartz.

Rootstock rather stout, creeping, bearing several fronds at the growing end; fronds 1–3 feet high, moderately long-stalked, ovate-oblong in outline, membranaceous, softly pubescent beneath, pinnate; pinnæ closely placed, linear-acuminate, 3–6 inches long, 5–7 lines wide, the lowest pair scarcely or not at all smaller, but somewhat deflexed, all pinnately incised three-fourths of the way to the midrib; segments very numerous,

crowded, obliquely oblong, acutish, basal ones longest; veinlets very evident, simple, the lowest ones of adjoining segments sometimes uniting, and sending a short free veinlet to the sinus between the segments; sori near the margin; indusia very pubescent.—Syn. Fil. p. 49.

Western Texas, *Wright, Lindheimer.* Near Santa Barbara, California, *Mrs. Cooper, Dr. Rothrock.* A specimen is preserved in the Hookerian herbarium marked "San Francisco, Calif., Dr. Sinclair," but no one seems to have collected it near that city in recent years. The species occurs also in Florida and throughout Tropical America, and has been found also in various warm regions of the Old World.

** *Texture firmer, or sub-coriaceous, veins forking freely.*

Aspidium Filix-mas, Swartz.

Rootstock short, stout, ascending or erect; fronds in a crown, on very chaffy stalks, half-evergreen, firm-membranaceous, 1–3 feet high, broadly oblong-lanceolate, slightly narrowed towards the base, sub-bipinnate; pinnæ from a broad base lanceolate-acuminate, pinnatifid almost to the midrib or again pinnate; pinnules oblong, smooth, palish beneath; in smaller fronds obtuse and sub-truncate, slightly toothed; in larger ones more elongated and pinnately incised; sori large, near the midvein, commonly only on the lower half or two-thirds of each segment; indusia convex when young, rather firm, smooth, orbicular-reniform, with a deep narrow sinus; rachises more or less setose-chaffy; chaff of the stalks bright-brown, of broad lanceolate-acuminate scales.—Syn. Fil. p. 55. *Nephrodium Filix-mas,* Richard. Hooker, Sp. Fil. iv, p. 116; British Ferns, t. 15. *Lastrea Filix-mas,* Presl. Moore, Nat. Print. Brit. Ferns, t. 14, 15, 16, 17.

Mountains of Colorado, *Dr. Scovill, Hall & Harbour, Brandegee.* Rocky Mts. of British Columbia and Dakota Territory to Lake Superior and Canada. Newfoundland, *fide Kunze.* If all the forms referred to the male Fern by Hooker really belong to it, the species is found in Europe, Asia, Africa, North and South America, the Hawaiian Islands, Japan, and Ceylon. Some of the Colorado specimens, and those sent from Owen Sound, Canada, by Mrs. Roy, are very large and fairly bipinnate, with deeply incised pinnules, and therefore belong to var. *incisum* of Moore. This species is given in Pursh's Flora as found from New Jersey to Virginia; but his specimens preserved in the Hookerian herbarium are partly *A. Goldieanum* and partly *A. cristatum.* *Nephrodium Floridanum,* Hooker, Fil. Exot. t. 99, is afterwards referred to *Filix-mas* by the illustrious Botanist who named it, but it seems to be rather a form of *A. cristatum.*

Aspidium rigidum, Swartz, *var.* **argutum.**

Rootstock short, stout, ascending or erect; fronds in a crown, on chaffy stalks, half-evergreen, firm-membranaceous, smooth and green above, paler and more or less glandular beneath, 1–3 feet high, ovate-lanceolate

or triangular-lanceolate, usually fully bipinnate; pinnæ broadly oblong-lanceolate, the lowest ones broadest and scarcely shorter than the middle ones; pinnules oblong, incised or doubly serrate, with spinulose teeth, conspicuously veiny; sori large, nearer the midrib than the margin; indusia firm, convex, orbicular, with a very narrow sinus, the edge bearing short-stalked glands.—*Aspidium argutum*, Kaulfuss, Enum Fil. p. 242. *Lastrea rigida*, "*larger and more developed*," Moore, Nat Print British Ferns. *Nephrodium rigidum*, ? var. *Americanum*, Hooker, British Ferns, t. 16; Sp. Fil. iv, p. 120.

Rocky cañons and hillsides of California, apparently rare east of the Coast Ranges, but extending northward to Umqua Co., Oregon (*Wilkes Expl. Exped.*), and southward to the Sierra Madre, Northwestern Mexico. It is also given by J. Smith in the Botany of the Herald as found in Panama and the Hawaiian Islands, but I suspect there is some error of either identification or locality. This is related to the last species, and small forms have been mistaken for it, but it has a broader and more compound frond, not or but very slightly narrowed towards the base; the under surface is somewhat glandular, and the plant very fragrant in drying; the teeth of the segments are softly spinulose, whence the name chosen by Kaulfuss, and the involucres have a very evident glandular margin. Hartweg's No. 2039, from near Monterey, is this species rather than *Filix-mas*, to which it has at times been referred. Our Fern differs from the European *A. rigidum*, with which is was united first by Moore and then by Hooker, only in the considerably greater size and the more decidedly spinulose teeth, and I see no good reason for still considering it distinct. The fragrance is equally characteristic of the European plant, and persists many years in herbarium specimens.

ASPIDIUM SPINULOSUM, var. DILATATUM, a form with dark scales on the stalk and smooth indusia, occurs in Oregon, but does not come within our limits.

§2. POLYSTICHUM.

Indusium orbicular and entire, peltate, fixed by the depressed centre: fronds evergreen, subcoriaceous; pinnæ and pinnules usually auricled on the upper side at the base, and mucronately serrate; veins free.

**Fronds simply pinnate.*

Aspidium Lonchitis, Swartz.

Utah, in the Wahsatch (*Watson*), and near Spring Lake, *Parry*. From British Columbia northward, and eastward to Montana, Lake Superior, and Canada. Greenland. Northern Europe and Asia, and in the high mountains of Southern Europe and Northern India.

Aspidium munitum, Kaulfuss.

Rootstock stout; stalks often a foot long, chaffy, like the rachis, with abundant glossy-brown scales; fronds growing in a crown 1–4 feet long, or even longer, lanceolate in outline, tapering slightly towards the base, pinnate; pinnæ very many, linear-acuminate, 3–4 inches long, subcoria-

ceous, often chaffy beneath on the midrib, very sharply and often doubly serrate; the teeth with commonly appressed needle-like points, the base of the pinnæ auricled on the upper and obliquely truncate on the lower side; sori abundant, forming a row each side the midrib midway between it and the margin.—Enum. Fil. p. 236. Hooker, Sp. Fil. iv, p. 10, t. 219.

California generally, extending through Oregon to Nutka in the north and Guadalupe Island (*Palmer*) in the south. The largest and finest specimens are from Crescent City (*Brewer*), and Port Orford, Oregon (*Gen. Kautz*). One of the handsomest of American Ferns, and, like many others, subject to considerable variations. The shaggy covering of the stalks and rachis consist usually of large cinnamon-brown chaff, intermixed with much smaller acuminate scales of the same color, but sometimes the color is much darker, and the scales mostly confined to the very base of the stalk.

Var. **nudatum.**

Frond smaller, the scales almost entirely lacking; pinnæ few and rather remote, short and broad, oblong-oval, the teeth closely appressed; sori scanty, on the ends of the few uppermost pinnæ.

Nevada Fall, Yosemite, *Prof. Wood.* Also from Moore's Flat, on the Yuba River, collector unknown. The lower portion of the stalk is missing: this was probably somewhat scaly, but the part preserved, and the whole frond, are absolutely naked, and have a pale, almost glaucous appearance.

Var. **imbricans.**

Frond smallish, not narrowed at the base; pinnæ crowded, lanceolate-oblong, pale, ascending and imbricated; fruit-dots nearer the margin than the midrib; stalk with shining brown lance-acuminate scales at the base, otherwise almost naked, as are the rachis and the frond.

Red Mountain, Mendocino Co. (*Kellogg*). Mts. near Trinity River (*Prof. Wood*). Plumas Co., *Mrs. Austin.* Still another form, with ample fronds, broad and somewhat incised pinnæ, and scattered sori, was collected by Dr. Lyall near the 49th parallel.

***Fronds bipinnate, or nearly so.*

Aspidium aculeatum, Swartz.

Rootstock stout, erect; stalks of variable length, commonly very chaffy, with large and small scales intermixed, as is the rachis; fronds 1–2 feet long, forming a crown, oblong-lanceolate, pinnate; pinnæ closely placed, lanceolate from a broad base, mostly curved upwards, incisely pinnatifid or again pinnate; the lobes or segments of variable shape, oval-rhomboidal, or unequally triangular-ovate and auriculate on the upper side of the slightly stalked base, entire or serrate or incised, the lobes and teeth of all degrees aculeate or needle-tipped; under surface more or less chaffy-

fibrillose; sori in two rows on the segments, nearer the midvein than the edge.—Syn. Fil. p. 53. *A. aculeatum*, var. *intermedium*, Hooker, British Ferns, t. 11.

Typical specimens were collected on the Coast Ranges, near Santa Cruz, California, by *Prof. Bolander*, and at Ukiah by *Dr. Kellogg*, and with them the two following, which had best be considered as varieties of this world-wide and exceedingly variable species.

Var. **Californicum.**

Frond elongated, thinly coriaceous, tapering slightly at the base; pinnæ but slightly incised above the middle, more and more deeply cleft towards the rachis, the lowest superior segment largest, but scarcely distinct as a pinnule, and not at all auricled.—*Aspidium Californicum*, D. C. Eaton, Proc. Am. Acad. vi, p. 555.

Mountains near Santa Cruz (*Bolander*). Ukiah, *Kellogg*. Frond long and narrow, as in *A. munitum*, and with similar chaffiness, but incised much as in the European var. *lobatum*.

Var. **angulare.**

Frond oblong-lanceolate, scarcely or not at all narrowed at the base, truly bipinnate; pinnules distinctly short-stalked, mostly auricled and slightly incised; the basal one largest and again pinnatifid; under surface chaffy-fibrillose.—*Aspidium angulare*, Willd. Sp. Pl. v, p. 257. *Polystichum angulare*, Presl; Moore, Nat. Print. Brit. Ferns, t. 12 and 13.

Mountains near Santa Cruz, *Bolander*. The fine specimen of this plant which came from the same region as the preceding forms is very closely similar to one from St. Martha's, Guilford, England, sent me by Mr. Thomas Moore. The lowest pinnæ are not reduced, as they are in var. *Braunii* (the form of Northern New England), and the pinnules are as distinctly separated as one ever sees them in that form, while they are much more incised.

§ 3. CYRTOMIUM.

Indusium orbicular as in § 2: fronds simply pinnate, with broad pinnæ; veinlets commonly connivent and uniting near the edges of the pinnæ.

Aspidium juglandifolium, Kunze.

Fronds a few inches to two feet long, coriaceous, pinnate; pinnæ short-stalked or the upper ones sessile, ovate-oblong or broadly lanceolate, the terminal one distinct and in small fronds the largest, the lateral ones one to six on each side, 2–6 inches long, one inch or more broad, sometimes acuminate, entire, appressed-serrulate, smooth on both surfaces; veins pinnated, the veinlets few, either free or uniting near the margin; sori scattered in

several irregular rows between the midrib and margins.—Linnæa, xx, p. 363. Hooker & Baker, Syn. Fil. p. 257.

A few specimens of a small form with free veins, answering to *Aspidium pumilum* (Martens & Galeotti, Fil. Mex. p. 64, t. 17, f. 1), were collected at the Hueco Tanks in Western Texas, and at Van Horn's Well. by the Botanists attached to the Mexican Boundary Commission in 1852, but the plant has not been collected within the United States since that time.

It is a common species in Mexico and Tropical America, and includes many nominal species as well as two genera, *Amblya* of Presl and *Phanerophebia* of Presl and Fée.

XIV. CYSTOPTERIS. Bernhardi.

Cystopteris fragilis, Bernh.

Common in rocky places from the Arctic regions to Chile in the west, and to South Africa and Tasmania in the east, everywhere variable in size, and in the breadth of the segments and the degree of their incision.

CYSTOPTERIS MONTANA, Bernh., with deltoid-ovate, delicately tripinnate, and almost quadripinnate fronds, and a long, slender, creeping rootstock, was collected many years ago in the Rocky Mountains of British America by *Drummond*, and more recently on the north shore of Lake Superior by *Macoun*, and in Labrador by *Rev. R. S. Butler*. It may possibly occur in California or Colorado.

XV. WOODSIA. R. Brown.

Woodsia scopulina, D. C. Eaton.

Rootstocks short, creeping, entangled, very chaffy; stalks 2–4 inches high, from bright ferruginous near the base becoming paler upwards, puberulent like the rachis and under surface of the frond with minute flattened hairs and stalked glands; fronds lanceolate, 4–8 inches long, pinnate; pinnæ numerous, 8–10 lines long, oblong-ovate, pinnatifid with 10–16 short ovate or oblong crenulate or toothed divisions; sori submarginal; indusium very delicate, deeply cleft into laciniæ, which terminate in short hairs composed of irregular cylindrical cells.—Canadian Naturalist, Apr. 1865, p. 90. Bot. of 40th Parallel, p. 397.

Oregon (*Brackenridge, Hall, Wood*), and in Mono Pass, California, at 9,000 to 10,000 feet elevation (*Bolander*), to Dakota and Minnesota in the north, and southwards to Arizona (*Palmer*) and Colorado, growing in dense masses on rocks and in their crevices. It has been collected also in British Columbia.

Woodsia Oregana, D. C. Eaton.

Much like the last in size and habit, but the stalks and fronds smooth; fertile fronds taller than the sterile ones; pinnæ triangular-oblong, obtuse, pinnatifid; segments oblong or ovate, obtuse, toothed or crenate; the teeth often reflexed and covering the submarginal sori; indusium very minute, divided almost to the centre into a few beaded hairs.—Can. Nat. l. c. Gray's Manual, ed. 5, p. 669.

Oregon to Lake Winnipeg, Wyoming Territory, and Lake Superior. Utah, Colorado, and Arizona, but not sent from California. This and the last have a continuous (not jointed) stalk, such as is found in *W. obtusa* and its immediate allies, but the indusium is rather that of *W. Ilvensis*, though very much reduced. Of the Texan plant (*C. Wright*, Nos. 830 and 2120), doubtfully referred to *W. obtusa*, I have as yet seen no specimens in a condition for satisfactory examination. Sir W. J. Hooker had placed his specimens in the same cover with *W. Peruviana*, and that species is now considered a var. of *W. obtusa* by Mr. Baker.

Suborder. SCHIZÆACEÆ.

XVI. ANEIMIA. Swartz.

Sporangia ovate, sessile, opening longitudinally, furnished with a transverse apical complete operculiform ring, placed in two rows on the back of the very narrow branchlets of the two long-stalked panicled lower branches of a pinnately divided frond, the fertile branches in a few species entirely distinct from the sterile frond. Veins free or anastomosing.—A genus of about twenty-seven species, none of them large Ferns, mostly South American, one being South African, and two coming within the borders of the United States.

Aneimia Mexicana, Klotzsch.

Rootstock creeping, densely covered with narrow subulate blackish chaff; fronds scattered, on slender stalks, pinnate; the two lower branches fertile, long-stalked, glandular-puberulent, bipinnate with densely clustered fructification; the rest of the frond like the sterile ones, deltoid-ovate, simply pinnate; pinnæ about six pairs and a rather large terminal odd one, short-stalked, broadly ovate-lanceolate from a rounded or slightly cordate base, sub-coriaceous, smooth and somewhat glossy; midrib very distinct; veins free, oblique, parallel, closely placed, once or twice forked, the veinlets running out into fine serratures.—Linnæa, xviii, p. 526. Kunze, Die Farrnk. ii, p. 75, t. 131. Hooker, Ic. Pl. x, t. 988.

Western Texas, *Lindheimer*, *Wright*. Also in various parts of Mexico. Plant a foot or eighteen inches high, the common stalk fully half of this height, smooth, except for a few scales near the base. The pinnæ are 2–2½ inches long and about one-third as broad, sub-coriaceous in texture, and finely striated by the slightly raised veinlets. *A. adiantifolia*, Swartz, with a sub-tripinnate sterile segment, occurs in Florida, and is common in the West Indies and Tropical America.

Order. OPHIOGLOSSACEÆ.

The *Ophioglossaceæ* are now considered an order distinct from *Filices*, distinguished by the erect vernation of the fronds, and by having the sporangia formed of the interior tissue of the frond, and not a mere transformation of surface-hairs, as in true Ferns. The prothallus, green and formed above-ground in *Filices*, is here devoid of chlorophyll and formed beneath the surface of the earth. Besides *Botrychium* and *Ophioglossum*, this order contains one other genus, *Helminthostachys*, represented by a single species found in India, Ceylon, the Philippines, etc.

I. BOTRYCHIUM. Swartz.

Botrychium Lunaria, L.

Bard Creek Valley, Colorado, *Dr. Parry*, Sept. 1874. This occurs sparingly from the Rocky Mountains of British America to Labrador, throughout Europe and Northern Asia, and is reported from Australia and Tasmania.

Botrychium simplex, Hitchcock, var. **compositum,** Lasch.

Sterile portion composed of two or three pinnately incised segments.—Milde, Fil. Eur. et Atl. p. 198.

Mount Lyell, California, in a glacial meadow at 10,000 or 11,000 feet elevation, *John Muir*. High Valley in Yellowstone Park, *Dr. Parry*. Lake Superior to New England. Northern and Middle Europe. The specimens from California are only one or two inches high, and have the sterile portion divided into three parts, the middle one largest, all of them pinnately incised. Those from Yellowstone Park are taller, and show grades of transition towards a simpler form. They are all rather stout, and have the sterile portion set well towards the base of the common stem. *Mr. J. W. Dun's* Botrychium, collected near Emigrant Gap, at 5,000 feet elevation, is probably this same thing, but I have not seen his specimens.

Botrychium lanceolatum, Angström.

Frond small, 3–9 inches high, somewhat fleshy; the sterile segment closely sessile at the top of a long common stalk, in the smallest forms 3-lobed, in larger ones broadly triangular, twice pinnatifid, the divisions lanceolate, entire, or toothed, all set on at an oblique angle; veins forking from a midvein; fertile segment short-stalked, slightly overtopping the sterile, 2–3-pinnate.—"Bot. Notis. (1854) p. 68." Milde, Filices Europæ et Atlantidis, p. 197. Eaton in Gray's Manual, ed. 5, p. 671.

On a grassy stream-bank, near Mt. Ouray, Colorado, *T. S. Brandegee*, 1877. Lake Superior to New York, Pennsylvania, and New England. Scandinavia, Lapland, and Siberia (*Milde*).

This species and the closely allied *B. matricariæfolium* will be illustrated in an early number of the "Ferns of North America."

Botrychium ternatum, Swartz.

Frond fleshy, the common stalk very short; sterile segment petioled, broadly pentagonal or triangular, ternate; the three primary divisions also petioled, as broad as long, pinnately decompound; ultimate divisions varying from round-reniform to triangular-lanceolate, entire or variously toothed and incised; fertile segment long-stalked, 2–4-pinnate.—Schraders Journal, 1800, p. 111; Syn. Fil. p. 172. Kunze, Die Farrnk. ii, p. 51, t. 221. Milde, Fil. Eur. et Atl. p. 199. *Osmunda ternata,* Thunberg, Flora Japonica, p. 329, t. 32. *Botrychium lunarioides,* Swartz. *B. fumarioides,* Willdenow. *B. australe,* R. Brown. *B. decompositum,* Martens & Galeotti, Fil. Mex. p. 15, t. 1.

Plumas Co., California, very large specimens, *Mrs. Pulsifer Ames* and *Mrs. R. M. Austin.* Mt. Rainier, etc., Washington Territory, *Brackenridge.* Geyser Springs, Yellowstone Park, *Dr. Parry.* Cascade Mts., British Columbia, *Dr. Lyall.* This species in one form or another occurs in America from Nutka Sound to New Granada, is rare and dwarfed in Europe, appears again in a large form in Eastern Asia, and reappears in Australia and New Zealand. Dr. Milde's arrangement of the various forms of the species in partly geographical and partly natural sections is unsuitable for a systematic work, but I will not at present attempt a new arrangement. Mrs. Ames's and Mrs. Austin's fine specimens accord best with the figure of Martens and Galeotti above referred to. Mrs. Austin also sends smaller specimens, but otherwise of the same general character.

Botrychium Virginianum, Swartz.

Wet Mountain Valley, Colorado, *Brandegee.* Meadow lands on the Mt. Rainier range, Washington Territory, *Brackenridge.* North America to Brazil. Also in parts of Europe and Asia and in Japan.

II. OPHIOGLOSSUM. Linnæus.

Ophioglossum vulgatum, Linn.

Sanoita Valley, Arizona, *Dr. Rothrock.* Texas, *Lindheimer, Wright.* Eastern North America, Europe, Asia, Africa, Australia, etc. Reported from Unalashka, but apparently not yet found in Oregon or California.

MUSCI.

By Thomas P. James, Cambridge, Mass.

The Botanists of this Exploration have proved themselves excellent bryological collectors, and have apparently made the collection of mosses a specialty, and have been careful to procure specimens mostly in a fruiting condition. Explorers generally ignore these minute objects, or consider them too trifling for their attention.

This enumeration presents several novelties not heretofore found in this country, and a few of rare species.

It is deemed advisable to add concise descriptions to the less known species.

Sphagnum acutifolium, Ehrh.—This specimen has the male organs beautifully developed in the purplish amentaceous branches in the coma and along the stem.

Hab.—Twin Lakes, in bogs and meadows.

Sphagnum cuspidatum, var. recurvum, Beauv.—Distinguished from the above by its flaccid, attenuated branches and spreading leaves, which, when dry, are undulated and slightly crisped.

Hab.—Twin Lakes, in swamps.

Gymnostomum rupestre, Schwæg.—This special plant has much resemblance to, and might be mistaken for, *G. curvirostrum*, but for the margin of its leaves being plane (not recurved).

Hab.—Twin Lakes, on damp clay ground.

Wiesia crispula, Hedw.—Known from *W. cirrhata* by its more crisped and plane-margined leaves and capsule without an annulus.

Hab.—Twin Lakes, on rocks in mountainous districts.

Cynodontium virens, Hedw.

Hab.—Twin Lakes, on old logs by mountain streams.

Cynodontium virens, var. serratum, B. & S.—Distinguished by its strongly serrated leaves and less strumose capsule.

Hab.—Twin Lakes, on old logs in bogs.

DICRANUM RHABDOCARPUM, Sulliv.—Densely cæspitose; stems dichotomously branched; leaves erect, concave, elongate-lanceolate; nerve vanishing below the apex; areolation loose; of a light shining green; capsule erect, cylindrical, regular, when dry 5- to 8-ribbed; no annulus; operculum obliquely rostrate.

Hab.—Mount Graham, Arizona, on rotten pine logs; rare.

POTTIA HEIMII, Hedw.—Tufted plants with flexuose oblong-lanceolate leaves, serrated at the apex, with a plane margin and nerve ceasing below the point; capsule oblong, and remarkable for the rostrate operculum adhering to the columella beyond the mouth of the capsule.

Hab.—Twin Lakes, on shaded ground.

DIDYMODON RUBELLUS, Bry. Eur.—Leaves intense dull green; lower ones invariably reddish, by which feature it is readily recognized.

Hab.—Twin Lakes, on wet banks; not rare.

DISTICHIUM CAPILLACEUM, Bry. Eur.

Hab.—Twin Lakes, on wet rocks on hillsides.

DISTICHIUM CAPILLACEUM, var. BREVIFOLIUM.—A smaller plant, with shorter leaves and smaller capsule.

Hab.—South Park, in wet, grassy ground.

DISTICHIUM INCLINATUM, Swtz., B. & S.—The shorter stem, more crowded leaves, and inclined oval capsule distinguish this from the preceding.

Hab.—Twin Lakes, in similar situations.

CERATODON PURPUREUS, Brid.

Hab.—Twin Lakes, Mount Graham, and Sierra Blanca, Arizona; very common.

CERATODON PURPUREUS, var. COMPACTUM.—In large, compact cæspites, in a barren condition.

Hab.—Twin Lakes, in very wet or boggy ground.

DESMATODON LATIFOLIUS, Bry. Eur.

Hab.—South Park, along streams.

DESMATODON LAURERI, Schultz.—In close, cæspitose tufts, stems branched, leaves crowded, oblong, obtuse, denticulate, with revolute, reflexed margins; curved oval capsule, supported by a long, arcuate or cygneous pedicel.

Hab.—Twin Lakes, on damp rocks; not common.

DESMATODON LAURERI, var. OVALIS.—A smaller plant, with broader leaves and larger, oval, nodding capsule, on a much shorter, upright, and slightly flexuose pedicel

Hab.—Twin Lakes, on shaded ground.

BARBULA MUCRONIFOLIA, Schwæg.

Hab.—Twin Lakes, on rocks; also a variety with a short mucro, similar to a variety of *B. subulata*, Brid.

BARBULA RURALIS, Hedw.

Hab.—Twin Lakes, on rocks; common.

GRIMMIA APOCARPA, Hedw.

Hab.—Twin Lakes, on rocks; common.

GRIMMIA PLATYPHYLLA, Mitt.—Distinguished from the above by its leaves being obtuse and more than twice as wide, imbricated when dry; the younger leaves terminating with a very short diaphanous apiculus; the perichætial leaves very laxly areolate for two-thirds of their length; the capsule large and immersed.

Hab.—Twin Lakes, on rocks; rare.

GRIMMIA ANODON, Brch. & Schp.—An interesting species, recognized by its small hoary cushions of dark green at the surface, leaves ending in a long hairy point, and the oval, gymnostomous, immersed capsule strongly ventricose.

Hab.—Twin Lakes, on dry rocks; not common.

GRIMMIA OVATA, Web. & Mohr.

Hab.—Twin Lakes, on exposed rocks on mountain sides.

GRIMMIA OVATA, var. *β*. AFFINIS, Brch. & Sch.

Hab.—In like situations.

GRIMMIA CALYPTRATA, Hooker.—In dense cushions; stem branched; the upper erect leaves ending with a long, slender, piliferous point, the cylindrical capsule covered with the large calyptra when mature.

Hab.—Twin Lakes, on dry rocks; not common.

HEDWIGIA CILIATA, var. LEUCOPHÆA, Brch. & Schp.—This variety is known by its ciliated, long, diaphanous points to the leaves.

ORTHOTRICHUM TENELLUM, Bruch.—In small cushions, with short,

branched stems, and loosely spreading, imbricated leaves; the subcylindrical, exserted capsule striated; calyptra hairy.

Hab.—Twin Lakes, on rocks; rare.

ORTHOTRICHUM TEXANUM, Sulliv.

Hab.—Twin Lakes, on shaded rocks.

ORTHOTRICHUM SPECIOSUM, Nees ab Es.

Hab.—Twin Lakes, on trees; not rare.

ENCALYPTA RHABDOCARPA, var.—This variety is distinguished by its papillose, piliferous leaves and its apophysate, striate capsule, without a peristome. It is probably a new species.

Hab.—Twin Lakes, under shelving rocks.

ENCALYPTA CILIATA, Hedw.

Hab.—Twin Lakes, on rocks and shaded ground.

TAYLORIA* SPLACHNOIDES, Hooker.—Loosely cæspitose; lower leaves oblong, upper obovate, acuminate, elongate-lanceolate, strongly dentate from the middle; capsule on a long, slender, pedicel, oblong subcylindric; neck rather long and narrow; operculum long conic; peristome very long and tortuous, and when dry reflexed.

Hab.—Twin Lakes, in damp situations shaded by rocks.

PHYSCOMITRIUM LATIFOLIUM, Drum.—This species is diminutive, and is distinguished by its broad and short concave leaves, short nerve, its serratures not so sharp; capsule oblong, neck long on a short pedicel, operculum conic and shortly apiculate.

Hab.—Twin Lakes, on the bare ground.

APHANORRHEGMA SERRATA, Sulliv.

Hab.—Twin Lakes, on the bare surface of the soil.

FUNARIA HYGROMETRICA, Hedw.

Hab.—Twin Lakes and Arizona; common.

LEPTOBRYUM PYRIFORME, Schp.

Hab.—Twin Lakes, in moist places under shade.

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*TAYLORIA—Cæspitose; stem radiculose; innovations dichotomose; leaves soft, erect, spathulate, and ovate-acuminate, coarsely serrated at the apex; areolation lax, diaphanous; nerve thin, ending below the apex. Capsule on a long pedicel, erect or inclined, when dry contracted below the mouth; apophysis clavate. Peristome single, inserted below the mouth; teeth 16 or 32—in pairs, very long, linear-lanceolate, hygroscopic, and when dry reflexed. Operculum conical or conico-rostellate; calyptra conico-mitriform or split on one side. Inflorescence monoicous; male organs capituliform.

WEBERA ACUMINATA, Brch. & Sch.—Densely cæspitose, monoicous; stem simple; lower leaves ovate-lanceolate, erect; upper fastigiate, crowded, twice as large, linear-lanceolate, margin revolute, serrate at the apex; nerve strong, excurrent; areolation lax; interior perichæte not revolute, entire; capsule on a shortish pedicel, cylindrical, long pyriform, long neck nodding; operculum conic-acuminate.

Hab.—Twin Lakes, in crevices of rocks in the shade; rare.

WEBERA ELONGATA, (Dicks.) Schwæg., var. ALPINUM, B. & S.

Hab.—Twin Lakes, in like situations.

WEBERA ELONGATA, var. MINUS, B. & S.

Hab.—Mount Graham sand-hills, Arizona.

WEBERA NUTANS, Schreb.

Hab.—Twin Lakes, on shaded ground.

WEBERA NUTANS, var. *β*. CÆSPITOSA, B. & S.

Hab.—Twin Lakes, in bogs.

WEBERA NUTANS, var. *γ*. BICOLOR, B. & S.

Hab.—Twin Lakes, at the base of trees in open woods.

WEBERA NUTANS, var. *ε*. LONGISETA, B. & S.

Hab.—Twin Lakes, in same localities.

BRYUM ULIGINOSUM, Brch. & Sch.—In this plant, the flowers are hermaphrodite, a rare occurrence with this species.

Hab.—Twin Lakes, in wet positions.

BRYUM PENDULUM, (Hornsch.) Schp.

Hab.—Twin Lakes, on low ground.

BRYUM PENDULUM, var.—The male gemma on separate branches.

Hab.—Twin Lakes, in similar places.

BRYUM INTERMEDIUM, Web. & Mohr.

Hab.—Twin Lakes, on moist rocks, and at Santa Fé, in New Mexico, in like situations.

BRYUM CIRRHATUM, Hopp. & Hornsch.

Hab.—South Park, on low ground.

BRYUM PALLESCENS, Schleich.

Hab.—South Park, on damp ground.

BRYUM PALLESCENS, var. *γ*. CONTEXTUM.

Hab.—South Park, on low boggy ground.

BRYUM PALLESCENS, var.—In this case, the inflorescence is hermaphrodite, a rare occurrence.

Hab.—South Park, in moist places.

BRYUM CÆSPITICIUM, Linn.

Hab.—Twin Lakes and South Park, in dry situations; not rare.

BRYUM ARGENTEUM, Linn.

Hab.—Twin Lakes, in dry positions; common.

BRYUM PSEUDOTRIQUETRUM, Hedw.

Hab.—Twin Lakes, in wet situations.

BRYUM PSEUDOTRIQUETRUM, var. COMPACTUM.

Hab.—Twin Lakes, in bogs.

BRYUM TURBINATUM, Hedw.

Hab.—Twin Lakes, on moist ground

BRYUM TURBINATUM, var. LATIFOLIUM, B. & S.

Hab.—Twin Lakes, in similar places.

ZIERIA* DEMISSA, (Hornsch) Schp.—This very interesting plant is known by its reddish tufts, short radiculose stems. Leaves, the lower ovate-acuminate, nerve ceasing below the point, the upper more pointed, nerve excurrent with long points. Capsule cernuous, incurved, clavate-pyriform, gibbous; mouth small, oblique; inner peristome longer than the teeth.

Hab.—Twin Lakes, in fissures of high rocks; very rare.

MNIUM AFFINE, var. ELATUM, B. & S.

Hab.—Twin Lakes, under shade in wet places.

MNIUM SERRATUM, Schrad.

Hab.—Twin Lakes, by the side of shaded rocks.

AMBLYODON DEALBATUS, Beauv.

Hab.—South Park, on wet ground.

MEESIA ULIGINOSA, Hedw.

Hab.—Twin Lakes, wet boggy ground.

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*ZIERIA—Small cæspites, dichotomously branched; stems radiculose; leaves densely imbricated, ovate, and oblong-acuminate; nerve excurrent cuspidate; margin entire; reticulation lax. Capsule on a short, sigmatized, horizontal or descending pedicel; operculum small, convex, apiculate, oblique. Annulus broad revoluble. Peristomal teeth narrow, lanceolate; internal membrane narrow; processes narrow, longer than the teeth.

AULACOMNION PALUSTRE, Schwæg.

Hab.—Twin Lakes, on bogs; very common.

PHILONOTIS MARCHICA, Brid.

Hab.—Twin Lakes, in springy places.

PHILONOTIS FONTANA, (Linn.) Brid.

Hab.—Twin Lakes, Mount Graham, Arizona, side of brooks.

PHILONOTIS FONTANA, var. GRACILIS.

Hab.—Mount Graham, Arizona; springy localities.

PHILONOTIS CALCAREA, Brch. & Sch.

Hab.—Twin Lakes and Santa Fé Creek, New Mexico, by the side of small streams.

TIMMIA MEGAPOLITANA, Hedw.

Hab.—Twin Lakes, on shaded rocky ground.

POLYTRICHUM JUNIPERINUM, Hedw.

Hab.—Twin Lakes, on moist ground.

MYURELLA JULACEA, Brch. & Sch.—Densely tufted; stems very slender, filiform, fragile. Leaves pale, glossy green, yellowish when old, closely imbricated, very concave, roundish-ovate, obtuse, nerveless, obscurely serrate at the apex, denticulate towards the base; areolation roundish; capsule suberect, oval oblong, tapering below, of a reddish-brown; peristome white; operculum conical.

Hab.—Twin Lakes, on wet banks; not common in a fruiting condition.

PSEUDOLESKEA ATROVIRENS, Dicks.—In loose patches, dioicous; stem prostrate, irregularly branched, incurved, slender, filiform; leaves imbricated, secund, ovate-lanceolate, acuminate, subserrulate; margin recurved; nerve thick, sub-continuous; areolæ small, oval.

Hab.—Twin Lakes, among other mosses on trees.

THUIDIUM BLANDOWII, Web. & Moh.

Hab.—Twin Lakes, in meadows.

ELODIUM PALUDOSUM, Sulliv.

Hab.—Twin Lakes, in wet and boggy stations.

CLIMACIUM DENDROIDES?, Web.

Hab.—Twin Lakes, in bogs and wet places; sterile.

BRACHYTHECIUM SALEBROSUM, Hoffm.

Hab.—Twin Lakes, on moist ground.

BRACHYTHECIUM COLLINUM, Schl.

Hab.—Twin Lakes, on the banks of creeks.

EURHYNCHIUM STRIGOSUM, Hoffm.

Hab.—Twin Lakes, by the roots of trees in woods.

EURHYNCHIUM PILIFERUM, Schreb.

Hab—Twin Lakes, on shaded ground.

AMBLYSTEGIUM SPRUCEI, Brch.—In small, dense cushions, dioicous; stems capillary, very minute and slender, sparingly and vaguely branched. Leaves remote, spreading, narrowly ovate-acuminate, almost entire, nerveless, loosely reticulated; perichætial leaves attenuated, serrate at the apex. Capsule erect or slightly curved, from a distinct neck, oval and obovate, and, when dry, widely obconic; peristome yellow; operculum conical, acuminate.

Hab.—Twin Lakes, in moist places on rocks.

AMBLYSTEGIUM SERPENS, Linn.

Hab.—Twin Lakes, on old logs, roots of trees, and on the ground in wet situations.

AMBLYSTEGIUM RADICALE, Brid.

Hab.—Twin Lakes, on old logs and wet ground.

HYPNUM STELLATUM, Schreb.

Hab.—Twin Lakes, on moist ground.

HYPNUM ADUNCUM, Hedw.

Hab.—Twin Lakes, on the banks of running streams.

HYPNUN ADUNCUM, var. *β.* GRACILLESCENS, B. & S.

Hab.—Twin Lakes, on damp, shady ground.

HYPNUM ADUNCUM, var. *δ.* TENUE, B. & S.

Hab.—Twin Lakes, in similar places.

HYPNUM ADUNCUM, var. *ε.* GIGANTEUM, B. & S.

Hab.—Twin Lakes, in standing water.

HYPNUM UNCINATUM, Hedw.

Hab.—Twin Lakes, on moist ground and old wood.

HYPNUM FILICINUM, Linn.

Hab.—Twin Lakes, along the banks of streamlets.

HYPNUM COMMUTATUM, Hedw.

Hab.—Twin Lakes, in wet places.

HYPNUM COMMUTATUM, var. *β.* FALCATUM, B. & S.

Hab.—Twin Lakes, in similar situations.

HYPNUM REPTILE, Michx.

Hab.—Mt. Graham, Arizona, on old rotten pine logs.

STEREODON PLICATILIS, Mitten.—Dioicous, fastigiately branched; leaves falcate, secund, broad, ovate-acuminate, when dry rugulose-subplicate, two very short nerves; margin reflexed, entire, on those of the branches serrulate at the points, the cells at the angles small and obscure; perichætial leaves erect, elongated, interior broad, oblong-lanceolate, subulate, entire, plicate. Capsule on an elongate pedicel, cylindrical, erect at the base, curved above; operculum conic; peristome light color.

Hab.—Twin Lakes, on old logs.

STEREODON COMPLEXUS, Mitten.—Dioicous, cæspitose; branches pinnate; leaves secund from a broad base, ovate-lanceolate, circinate, concave, two small nerves; margin subentire, many short, obscure, subquadrate cells at the basal angles; perichætial leaves erect, oblong, subulate, interior suddenly subulate, subserrate, plicate; capsule on a red pedicel, cylindrical, unequal, inclined; persistome yellow; operculum conic.

Hab.—Twin Lakes, on shaded rocks.

LIMNOBIUM PALUSTRE, Linn.

Hab.—Twin Lakes, at the base of trees at the water's edge.

LIMNOBIUM PALUSTRE, var. SUBJULACEUM.

Hab.—Twin Lakes, in like situations.

LIMNOBIUM OCHRACEUM.—Turn.

Hab.—Twin Lakes, on wet ground.

CAMPTOTHECIUM NITENS, Schreb.

Hab.—Twin Lakes, among grass in meadows.

HEPATICÆ.

By C. F. Austin.

Riccia Frostii, Austin.
Riccia Watsonii, Austin.
Riccia crystallina, Linn.
Riccia fluitans, var. lata.
Marchantia polymorpha, Linn.
Chiloscyphus polyanthos, var. rivularis.
Jungermannia bicuspidata, Linn.
Jungermannia incisa, Schd.
Jungermannia Hornschuschiana, Nees.
Jungermannia Bautriensis, Hook., var. Müller, Lindb.
Jungermannia cordifolia, Hook.
Jungermannia ventricosa, Diks.
Scapania compacta, Roth.
Scapania udulata, Nees.
Scapania uliginosa, Swartz, Nees.

LICHENES.

By Professor Edward Tuckerman.

Cetraria aculeata, (Schreb.) Fries.—Earth, Montezuma Pass, Colorado.

Cetraria madreporiformis, (Ach.) Müll.—Earth, Montezuma Pass, Colorado.

Cetraria Islandica, (L.) Ach.—Earth, South Park, Colorado.
Cetraria nivalis, (L.) Ach.—Earth.
Evernia vulpina, (L.) Ach.—Colorado and Arizona.
Usnea barbata, (L.) Fr., var. dasypoga.—Valley of the Rio Grande.
Usnea cavernosa, Tuckerm.—Valley of the Rio Grande and Arizona.
Alectoria jubata, (L.), var. inflexa, Fries.—Valley of the Rio Grande.

PARMELIA CONSPERSA, (Ehrh.) Ach., var. MOLLIUSCULA, Tuckerm.—Earth, South Park, Colorado.

UMBILICARIA VELLEA, (L.) Nyl., probably, but all the specimens are infertile.—On rocks, Twin Lakes, Colorado.

PELTIGERA VENOSA, (L.) Hoffm.—On earth, Twin Lakes.

PELTIGERA APHTHOSA, (L.) Hoffm.—Earth, Twin Lakes.

PELTIGERA HORIZONTALIS, (L.) Hoffm.—Earth, Twin Lakes.

PELTIGERA CANINA, (L.) Hoffm.—Earth, Twin Lakes.

SOLORINA SACCATA, (L.) Ach., var. SPONGIOSA, Nyl. (*S. bispora.*)—Trout Creek and South Park, on the earth.

PANNARIA HYPNORUM, (Hoff.) Koerb.—Earth, Twin Lakes, Colorado.

PANNARIA BRUNNEA, (Sw.) Mass.—Earth, Twin Lakes

LEPTOGIUM TREMELLOIDES, (L. fil.) Fr.—On rocks, Twin Lakes.

PLACODIUM VITELLINUM, (Ehrh.) Naeg. & Hepp.—On the earth, Colorado.

PLACODIUM SINAPISPERMUM, (DC.) Hepp.—Earth, Twin Lakes.

PLACODIUM JUNGERMANNIÆ, (Vahl, Th. Fr.).—Earth, Twin Lakes.

LECANORA RUBINA, (Vill.) Schær.—Rocks, Twin Lakes, Colorado, and Arizona.

LECANORA CASTANEA, (Hepp.).—Earth, Twin Lakes.

RINODINA TURFACEA, (Wahl) Koerb.—Earth, Twin Lakes.

CLADONIA FIMBRIATA, (L.) Fr.—Earth, Twin Lakes.

CLADONIA CARIOSA, (Ach.) Floerk.—Earth, Twin Lakes.

CLADONIA GRACILIS, (L.) Fr., var. HYBRIDA, Schær.—Earth, North Branch of South Platte.

BIATORIA CRENATA, (Tayl.) Tuckerm.—Earth, mountains of Arizona.

BUELLIA PAPILLATA, (Sommer f.) Tuckerm.—Earth, Twin Lakes, Colorado.

APPENDIX.

CALIFORNIA COLLECTION.

In the way of general considerations on the flora of our route in California, there is but little for me to say as a preface to this *mere catalogue:* first, because of the publication of the Botany of California. For the same reason I have excluded descriptions and kept this apart from the body of my report. American botanists have reason to congratulate the authors and themselves on the probable early completion of that great work. Second, because, upon the essential facts of the history of botany there, Prof. D. C. Eaton has dwelt in the preface to his article on the Ferns of the Southwest, which forms a most valuable addition to this volume; and, third, because the important facts, so far as observed by us, have been already published in the Report of this Survey for 1876.

There are, however, a few facts to which it might be well to allude: and the first one is the marked change which occurs in the character of the arborescent vegetation as we go north from Walker's Basin along the Kern River Valley and up the South Fork of that stream. After passing Havilah (a few miles north of Walker's Basin), no oak trees were seen along our route to the base of Fisherman's Peak, until, on the return trip, we reached the Soda Spring on the North Fork of Kern River. Here they again appeared, and as we moved south toward Deer Creek and Linn's Valley they became common, until in the last-named region they were more abundant in the lower grounds than the coniferous vegetation, which had hitherto given exclusive character to the landscape.

It was further worthy of note that no *Sequoia gigantea* was seen on the eastern side of the North Fork of Kern River or anywhere on the South Fork, though situations were frequently noted at which, so far as the ordinary physical conditions of soil, exposure, etc., were concerned, it might have been expected, especially so as it is now well known to be common on the western slope of valleys drained by the headwaters of

Tule River, and also on the eastern slope of valleys tributary to the North Fork of Kern River. This seems to lead to the conclusion that its distribution, as indicated by Mr. Muir, is due to causes long ago operative; and that, further, its tendency "to spread" is not great.

On the southern slope of a peak to the south of Mount Whitney, we found the present growth of trees at timber-line all dead or dying, and no younger ones taking their places, so that, in a few years, the timber-line will be several hundred feet lower than at present. I am quite unable to give any *satisfactory* explanation of the fact, *unless* it be due to a washing away of the soil by the melting snows: still, it is worth recording.

As a general statement, it may be said that in the Southern Sierras, as well as in portions of the Coast Range, at an elevation of 5,000 feet, we find open grounds, at times dry, but frequently moist enough to come under the general denomination of meadows, and that these extend through the valleys up to an elevation of nearly 12,000 feet, as at the base of Mount Whitney. Ordinarily, they would have been "well grassed", and furnished an abundant botanical harvest, but the immense bands of sheep had denuded them of every living, green thing, save sage-brush, and had actually trampled the soil into a dust, even destroying the roots of the grass in great measure. This is to be remembered in connection with the possible disappearance of some local species of plants, the modification of the flora as regards the proportions of existing plants, and even by repeated "cropping" changing the entire habit of others The influence of the sheep and their herders in destroying the young timber has been adverted to in the general considerations in the early part of the volume.

RANUNCULACEÆ.

Clematis ligusticifolia, Nutt., var. Californica, Watson.—Head of Peru Creek, at 5,100 feet altitude (229). Brewer and Watson in Flora of California, 1, p. 3.

Thalictrum Fendleri, Engelm.—Santa Barbara (111), *l. c.* p. 4.

Ranunculus aquatilis, L., var. trichophyllus, Chaix.—Walker's Basin, at 3,440 feet altitude (291 and 304), *l. c.* p. 5.

Ranunculus Cymbalaria, Pursh, *l. c.* p. 7.

DELPHINIUM DEPAUPERATUM, Nutt.—Near base of Mount Whitney (395), *l. c.* p. 11.

ACONITUM FISCHERI, Reich, (373), *l. c.* p. 12.

PAPAVERACEÆ.

DENDROMECON RIGIDUM, Benth.—Island of Santa Cruz, off Santa Barbara, growing on rocky hillsides, *l. c.* p. 22.

ESCHSCHOLTZIA CALIFORNICA, Cham.—Quite abundant near Santa Barbara, where it is one of the most characteristic plants (86), *l. c.* p. 22.

CRUCIFERÆ.

NASTURTIUM OFFICINALE, R. Br.—I found it, in 1875, in the Coast Range, in places where it is almost impossible to believe it had been introduced. So general is the conviction that it is not indigenous, that I hesitate to offer my opinion that it is a native, at least, in some places where now found. I can understand that once introduced into a stream, it may be transported by the current to any distance; but throwing out the agency of birds and similar means of transportation, as entirely inadequate to account for its distribution, I cannot comprehend how it should now be found so frequently at the very fountain head of some streams in places so remote and inaccessible as to have only recently been visited by whites.* Found also at Elizabeth Lake, *where it may have been introduced* (188) *l. c.* p. 43.

NASTURTIUM OBTUSUM, Nutt., var. ALPINUM, S. Watson.—South Fork of Kern River, at 8,200 feet altitude. I think Mr. Watson correct in regarding this a mere variety. From the limited material at my command, I infer, however, that its characters are tolerably constant, especially the relative length of pedicels and pods (322), *l. c.* p. 613.

CARDAMINE GAMBELLII, Watson, *l. c.* p. 30.—Not common; found only near Santa Barbara.

SISYMBRIUM CANESCENS, Nutt.—Head of Peru Creek; altitude 5,100 feet (230), *l. c.* p. 40.

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*As not entirely irrelevant, I may quote from De Candolle, Géographie Botanique, p. 746, footnote (*a*): "Le *Nasturtium officinale* et le *Barbarea vulgaris*, par exemple, se trouvent sur la côte nord-ouest, et MM. Torrey et Gray les regardent comme introduits dans les anciens Etats de l'Union. Il est possible qu'ils soient venus d'Europe, mais ils peuvent aussi être venus d'ailleurs, ou avoir été primitivement plus repandus en Amérique."

Sisymbrium incisum, Engelm., (369), *l. c.* p. 41.

Brassica nigra, Boiss.—Introduced, and has become a most obnoxious weed in some parts of California. Sometimes growing 8–10° high, as in the western portion of the Santa Clara Valley, *l. c.* p. 39.

CAPPARIDEÆ.

Isomeris arborea, Nutt.—The common dry ground shrub in portions of the Santa Clara Valley (179), *l. c.* p. 50.

CISTINEÆ.

Helianthemum scoparium, Nutt.—Bartlett's Cañon near Santa Barbara (125), *l. c.* p. 54.

FRANKENIACEÆ.

Frankenia grandifolia, Cham. & Schlecht.—Santa Barbara, where it is the common weed of the seashore (55, 96), *l. c.* p. 60.

CARYOPHYLLEÆ.

Silene laciniata, Cav.—Santa Barbara (141), *l. c.* p. 64.

Silene Gallica, L.—Santa Barbara, where it is evidently introduced (160), *l. c.* p. 63.

Stellaria longipes, Goldie, (310), *l. c.* p. 68.

Sagina Linnæi, Presl.—Manachi Meadows, at 8,000 feet altitude (311), *l. c.* p. 70.

Lepigonum medium, Fries. (*Spergularia media*, Presl.)—Santa Barbara (154), *l. c.* p. 71.

HYPERICINEÆ.

Hypericum Scouleri, Hook., *l. c.* p. 81.

MALVACEÆ.

Sidalcea malvæflora, Gray, *l. c.* p. 83.

Malvastrum splendidum, Kellogg?—Bartlett's Cañon, near Santa Barbara (120), *l. c.* p. 85.

STERCULIACEÆ.

FREMONTIA CALIFORNICA, Torr.—Known to the miners and ranchmen near Fort Tejon as "*Slippery Elm.*" The inner bark abounds in mucilaginous properties when moistened, and is used as a substitute for *Ulmus fulva*. *l. c.* p. 88.

GERANIACEÆ.

ERODIUM CICUTARIUM, L'Her.—Santa Barbara (158), where it is by many supposed *not to have* been introduced. It is somewhat remarkable that widely diffused as this plant is, I have never yet seen it growing where its introduction from Europe was not to my mind the most natural way of accounting for its presence, usually infesting the neighborhood of ranches and towns. *l. c.* p. 94.

RHAMNEÆ.

RHAMNUS CALIFORNICA, Esch. (*Frangula Californica*, Gray, Gen. Ill. 2, t. 167.)—Sometimes called California Coffee, for, so far as I know, *no reason*. Santa Barbara (108). (226), head of Peru Creek, at 5,150 feet altitude, appears to be var. TOMENTELLA, Gray, of this same species; *l. c.* p. 101.

CEANOTHUS DIVARICATUS, Nutt.—"Blue Brush," among which the deer lie, and on which they browse. At middle altitudes (354). This shrub is among the number that go to make up the dense chaparral of the California hillsides; *l. c.* p. 103.

CEANOTHUS SPINOSUS, Nutt.—Santa Barbara (132), *l. c.* p. 103.

AMPELIDEÆ.

VITIS CALIFORNICA, Benth.—Tejon Ranch (280). So far as I know, the only wild grape of California; *l. c.* p. 105.

SAPINDACEÆ.

ÆSCULUS CALIFORNICA, Nutt.—Common by the streams and on the hillsides near the Southern Sierras (258), *l. c.* p. 106.

NEGUNDO CALIFORNICUM, T. & G.—Tejon Cañon (264), *l. c.* p. 108.

LEGUMINOSÆ.

By Sereno Watson.

Lupinus * arboreus, Sims.—Common near the coast; Santa Barbara (27, 89 *bis*), the form with purplish flowers, *l. c.* p. 117.

Lupinus rivularis, Doug.—Frequent in the mountains from Oregon to Southern California; Manachi Meadows, at 9,500 feet altitude, Rothrock (328), *l. c.* p. 118.

Lupinus albicaulis, Dougl—Frequent from Oregon to Southern California; on Mount Piños, at 7,000 to 8,500 feet altitude (206, 209), *l. c.* p. 118.

Lupinus Andersoni, Watson, var.—Was scantily collected on the North Fork of Kern River (405). It is more slender than the type, the dense pubescence less silky, the racemes few-flowered, and both the standard and keel naked. It does not seem exactly referable to any known species; *l. c.* p. 120.

Lupinus confertus, Kellogg (Proc. Calif. Acad. ii, 192, fig. 59).—In the Sierra Nevada, at Manachi Meadows, 8,200 feet altitude (305), *l. c.* p. 120.

Lupinus Breweri, Gray (Proc. Am. Acad. vi, 334).—In the Sierra Nevada; on Mount Piños, Rothrock (28, 270), *l. c.* p. 122.

Lupinus Lyallii, Gray, var. Danaus, Watson (Proc. Amer. Acad. viii, p. 534).—The pubescence less dense. The typical form in the Cascade Mountains; the variety in the Sierra Nevada, on the North Fork of Kern River, at 8,000 feet altitude (407). Fl. Cal. p. 122.

Lupinus affinis, Agardh.—From the Sacramento to San Diego; found in Bartlett's Cañon, near Santa Barbara (129); *l c.* p. 122.

Lupinus nanus, Dougl.—Frequent from the Sacramento Valley southward; Santa Barbara (90); *l. c.* p. 123.

Lupinus luteolus, Kellogg (Proc. Calif. Acad. v. 38). (*L. Bridgesii*, Gray; Watson, Proc. Am. Acad. viii, 538.)—In the Coast Ranges from Mendocino County southward; at head of Peru Creek, Ventura County, Rothrock (224); *l. c.* p. 125.

[* For full synonymy of the species of *Lupinus*, see Watson, Revis. Lup. in Proc Am. Acad. viii, 539, and Brewer and Watson in Fl. Calif. 1, 116; as also the Index to North American Botany, by Mr. Watson, p. 234 *et seq.*—J. T. R.]

MEDICAGO DENTICULATA, Willd.—"Bur Clover." Santa Barbara (107); *l. c.* p. 133.

MELILOTUS PARVIFLORA, Desf.—"Sweet Clover." Santa Barbara (25); *l. c.* p. 132.

TRIFOLIUM MEGACEPHALUM, Nutt.—Northeastern California, *l. c.* p. 127.

TRIFOLIUM INVOLUCRATUM, Willd., var. HETERODON, Watson.—Los Angeles (26); at Manachi Meadows (300); near Fort Tejon (216); at head of Peru Creek (237), and at Walker's Basin (285); *l c.* p. 130.

TRIFOLIUM TRIDENTATUM, Lindl. (Torr. & Gray, Fl. 1, 692), var. OBTUSIFLORUM, Watson (426), Weldon; also var. MELANANTHUM, Watson (189), Weldon; *l. c.* p. 130.

TRIFOLIUM MONANTHUM, Gray (Proc. Am. Acad. vi, 523).—At Manachi Meadows (307), and on the North Fork of Kern River, at 9,000 feet altitude (413), *l. c.* p. 131.

HOSACKIA OBLONGIFOLIA, Benth. (Pl. Hartw. 305).—Santa Barbara (289), *l. c.* p. 135.

HOSACKIA TORREYI, Gray (Proc. Am. Acad. viii, 625).—In the Sierra Nevada, on the North Fork of Kern River, at 8,500 feet altitude (411), and at Cuddy's Ranch, near Fort Tejon (215), *l. c.* p. 135.

HOSACKIA PURSHIANA, Benth.—Ojai Creek Valley (178), *l. c.* p. 137.

HOSACKIA GLABRA, Torrey (Bot. Wilkes Exp. 274). (*H. scoparia*, Nutt.)—Frequent in the Coast Ranges of California; Santa Barbara, Rothrock (24); *l. c.* p. 137.

PSORALEA MACROSTACHYA, DC.—Throughout California; Ojai Creek Valley (172); *l. c.* p. 140.

ROSACEÆ.

ADENOSTOMA FASCICULATUM, Hook. & Arn., *l. c.* p. 184.

CHAMÆBATIA FOLIOLOSA, Benth. (Torr. Pl. Fremontianæ, p. 11, tab. vi), *l. c.* p. 173.

CERCOCARPUS PARVIFOLIUS, Nutt.—Fort Tejon (196), where, with a scrub oak and *Ceanothus spinosus*, it forms the densest of chaparral,* *l. c.* p. 174.

*The use of the term *chaparral* should strictly be confined to thickets or "plantations" of evergreen oaks. Common usage in California and along our Mexican border connects it with almost any dense thicket of a low, shrubby growth.

CERCOCARPUS LEDIFOLIUS, Nutt.—Southern Sierras (330), *l. c.* p. 174. "Mountain Mahogany."

POTENTILLA GLANDULOSA, Lindl., var. NEVADENSIS, Watson.—Kern River, at 9,850 feet altitude (376), *l. c.* p. 178.

POTENTILLA GRACILIS, Dougl., var. RIGIDA, Watson.—In my specimens, from head of Peru Creek, the leaflets are from $1\frac{1}{2}$–$2\frac{1}{2}'$ long (243); *l. c.* p. 179.

POTENTILLA WHEELERI, Watson (Proc. Am. Acad. xi, p. 148).—Southern Sierra Nevada, on Mount Olanche, at 8,200 feet altitude; *l. c.* p. 179.—PLATE III, B. Plant about natural size. Fig 4. Flower, seen from above; 5, seen from beneath; 6, vertical section of flower; all enlarged about 8 diameters. Fig. 7. A single pistil.

HORKELIA CALIFORNICA, Ch. & Sch.—Santa Barbara (21, 19), *l. c.* p. 181.

HORKELIA PURPURASCENS, Watson (Proc. Am. Acad. xi, p. 148).—"Collected by Dr. J. T. Rothrock on the headwaters of Kern River, at 9,000 feet altitude. An unmistakable Horkelia, but like *H. tridentata*, intermediate between the typical species and those of *Ivesia*, leaving it almost impossible to preserve the latter genus distinct. Specimens of *H. tridentata* have recently been found with decidedly deltoid filaments, showing that this character may fail even to be specific." To the above remarks I can only add that in a flower of *H. purpurascens* I have found the distinction between the subulate and filiform filaments to fail, as *all* were between subulate and deltoid, except two, which were *rather* deltoid, thus destroying the shape of the filaments entirely as a specific character. The varying number of carpels in both genera is another fact indicating still further the necessity of uniting *Ivesia* to this genus. I imagine that most American botanists will continue to keep up the distinction between this genus and *Potentilla*, whatever may become of *Ivesia*. *l. c.* p. 182.—PLATE III, A. Plant natural size. Fig. 1. Unopened flower-bud; 2, expanded flower; 3, petals of flower removed and calyx laid open to show the character and insertion of the stamens; all enlarged about 6 diameters.

IVESIA SANTALINOIDES, Gray (Proc. Am. Acad. vi, 531, and vii, 339).—Mount Piños, at 8,500 feet altitude, *l. c.* p. 183.

ROSA CALIFORNICA, Ch. & Schl.—Santa Barbara, and to an elevation of 5,100 feet in the Coast Range (22, 228, 23), *l. c.* p. 187.

HETEROMELES ARBUTIFOLIA, J. Rœm. (*Photinia arbutifolia*, T. & G. Fl. 1, p. 473.)—Tree as seen by me at Santa Barbara 12–20° high. Called by *some* of the natives "California Laurel"; *l. c.* p. 188.

SAXIFRAGEÆ.

BOYKINIA OCCIDENTALIS, T. & G.—Bartlett's Cañon, Santa Barbara (118), *l. c.* p. 196.

RIBES MENZIESII, Pursh—Santa Barbara (116), *l. c.* p. 204.

RIBES CEREUM, Dougl. (267), *l. c.* p. 207.

CRASSULACEÆ.

COTYLEDON LAXA, Benth. & Hook.—Bartlett's Cañon, near Santa Barbara, *l. c.* p. 212.

LYTHRARIEÆ.

LYTHRUM ALATUM, Pursh, var. LINEARIFOLIUM, Gray.—Fort Tejon (191), *l. c.* p. 214.

ONAGRARIEÆ.

EPILOBIUM OBCORDATUM, Gray (Proc. Amer. Acad. vi, 532).—Sierras at 11,000 to 13,000 feet altitude (400); *l. c.* p. 218.

EPILOBIUM COLORATUM, Muhl. (143, 217), *l. c.* p. 219.

EPILOBIUM ORIGANIFOLIUM, Lam. (*E. alpinum*, L., var. *majus*, Wahl., of Gray's Manual.)—Headwaters of Kern River (361), *l. c.* p. 219.

EPILOBIUM PANICULATUM, Nutt.—Head of Peru Creek, at 5,100 feet altitude (242), *l. c.* p. 220.

GAYOPHYTUM DIFFUSUM, T. & G., (225, 346), *l. c.* p. 221.

ZAUSCHNERIA CALIFORNICA, Presl.—Common in California, *l. c.* p. 218.

CLARKIA ELEGANS, Lindl.—Santa Barbara (13), *l. c.* p 232.

ŒNOTHERA BIENNIS, L., var. GRANDIFLORA, Lindl.—Walker's Basin, at 3,440 feet altitude (295), *l. c.* p. 223.

ŒNOTHERA CALIFORNICA, Watson, Fl. Cal.—Weldon (425), *l. c.* p. 223.

ŒNOTHERA CHEIRANTHIFOLIA, Hornem., var. SUFFRUTICOSA, Watson.—Santa Barbara (18), *l. c.* p. 225.

ŒNOTHERA BISTORTA, Nutt., var.? VEITCHIANA, Hook.—Plains about Fort Tejon. W. L. Kennedy. *l. c.* p. 225.

ŒNOTHERA MICRANTHA, Hornem.—Santa Barbara, *l. c.* p. 226.

BOISDUVALIA DENSIFLORA, Watson.—Head of Peru Creek, at 5,100 feet altitude (235), *l. c.* p. 233.

LOASEÆ.

MENTZELIA GRACILENTA, T. & G.—Head of Peru Creek, at 5,100 feet altitude (15, 222), *l. c.* p. 236.

MENTZELIA LÆVICAULIS, T. & G.—Walker's Basin, at an altitude of 3,440 feet (281), *l. c.* p. 237.

DATISCEÆ.

DATISCA GLOMERATA, Benth. & Hook.—Ojai Creek (174), *l. c.* p. 242.

CACTEÆ.

OPUNTIA ENGELMANNI, Salm, var.? LITTORALIS, Engelm. Fl. Cal. 1, p. 248.—Erect, spreading (2–4 feet high), with large oval joints (6–12 inches long), bearing rather distant branches with a few rather slender, spiny, large, yellow flowers, and large, obovate, juicy, purple fruit, with very numerous small seeds.—Santa Cruz Island (10), and along the coast of Southern California.

FICOIDEÆ.

MESEMBRYANTHEMUM CRYSTALLINUM, L.—Islands and seashore near Santa Barbara (8), *l. c.* p. 251.

UMBELLIFERÆ.

CARUM GAIRDNERI, Benth. & Hook.—Southern Sierras, at 7,500–10,000 feet altitude (32, 370, 384), *l. c.* p. 259.

BERULA ANGUSTIFOLIA, Koch.—San Luis Valley, Colorado, *in hot springs* the temperature of which is 80° Fahrenheit, and in spring water at Fort Tejon, California, where the water has a temperature of 62° Fahrenheit. In neither of these locations was there much of a yearly variation in temperature of the water, yet in one instance, as in the other, the plant grew luxuriantly; the difference in temperature of the water at the two places being 18° Fahrenheit (732, 262); *l. c.* p. 260. See page 133 of this volume.

ŒNANTHE CALIFORNICA, Watson (Proc. Amer. Acad. xi, 139).—Santa Barbara (29, 30, 31), *l. c.* p. 264.

ANGELICA LINEARILOBA, Gray.—South Fork of Kern River, at 9,800 feet altitude (386), *l. c.* p. 266.

CAPRIFOLIACEÆ.

SAMBUCUS GLAUCA, Nutt.—Santa Barbara. From the odor of the bruised leaves and flowers, a much more appropriate name would have been *fætidissima* (1), *l. c.* p. 278.

LONICERA INVOLUCRATA, Banks.—Santa Barbara (109), *l. c.* p. 280.

COMPOSITÆ.

EUPATORIUM OCCIDENTALE, Hook.—Olanche Mountain, at 9,500 feet altitude (360), *l. c.* p. 299.

GUTIERREZIA EUTHAMIÆ, T. & G., (181), *l. c.* p. 302.

GRINDELIA ROBUSTA, Nutt.—Santa Barbara (84); common near the sea-shore. Of late, this plant has been put forward prominently among new remedies. I imagine it will ere long share the fate of some other like-vaunted remedial agents. 'Si vulgus vult decipi, decipiatur,' Dr. Darlington once wrote of another doubtful remedy; *l. c.* p. 304.

CHRYSOPSIS SESSILIFLORA, Nutt.—Fort Tejon (197, 272). See Fl. Cal. vol. 1, p. 309.

APLOPAPPUS BLOOMERI, Gray.—Olanche Mountain, at 10,000 feet, *l. c.* p. 313.

BIGELOVIA, near to *Parryi*, with scales of the involucre more attenuated at the tips, and leaves longer.—Mount Olanche, at 10,000 feet altitude (356).

BIGELOVIA DOUGLASII, Gray, var. SERRULATA, Gray, Fl. Cal. 1, 318.—Manachi Meadows at 8,250 feet, and Mount Piños at 8,500 feet (366, 211).

The var. TORTIFOLIA, Gray, Fl. Cal., is from Mount Piños, at 8,600 feet (268).

BIGELOVIA GRAVEOLENS, Gray, *l. c.* 317.—Walker's Basin, 3,440 feet (428).

BIGELOVIA GRAVEOLENS, Gray, var. GLABRATA, Gray, Fl. Cal. 1, 519, near Fort Tejon, at 5,100 feet (271), and var. ALBICAULIS, Gray, nearly, from Mount Piños, at 7,900 feet (265).

SOLIDAGO CALIFORNICA, Nutt.—Santa Barbara (105).

SOLIDAGO CALIFORNICA, Nutt., var. NEVADENSIS, Gray.—Walker's Basin at 3,440 feet (279), *l. c.* 319.

SOLIDAGO GUIRADONIS, Gray (Proc. Am. Acad. vi, 543).—Fort Tejon, 3,150 feet (193); Cuddy's Ranch (near Tejon), at 5,150 feet (254); Walker's Basin, at 3,440 feet (290), Fl. Cal. 1, 319. My specimens appear to have rather broader and more obtuse scales to the involucre than usual.

SOLIDAGO ELONGATA, Nutt.—Soda Spring, North Fork of Kern River, at 6,900 feet altitude (418), *l. c.* 319.

SOLIDAGO OCCIDENTALIS, Nutt.—South Fork of Kern River, at 6,000 feet altitude, *l. c.* 318.

LESSINGIA NANA, Gray.—Walker's Basin, at 3,440 feet. It was about the only plant remaining on the ground over which sheep had been driven so frequently as to destroy all other vegetation, *l. c.* 307.

LESSINGIA RAMULOSA, Gray, var. TENUIS, Gray.—Head of Peru Creek, at 5,100 feet, *l. c.* 307.

CORETHROGYNE FILAGINIFOLIA, Nutt., var. TOMENTELLA, Gray.—Cuddy's Ranch, near Fort Tejon, at 5,150 feet altitude, *l. c.* 320.

ASTER CANESCENS, Pursh. (*Machæranthera canescens*, Gray.)—Olanche Mountain, at 10,000 feet altitude (359), *l. c.* 322.

ASTER MENZIESII, Lindl.—Head of Peru Creek, at 5,100 feet (239), *l. c.* 323.

ASTER ÆSTIVUS, Ait. (?)—Two forms (396) from Southern Sierras, at 2,000 feet altitude, and (283, more luxuriant) from Walker's Basin, at 3,440 feet, have been doubtfully placed here by Dr. Gray. *l. c.* 614.

ASTER ADSCENDENS, Lindl. ?—Soda Spring, North Fork of Kern River, at 6,900 feet (417), *l c.* 324.

ASTER ANDERSONII, Gray.—Mount Whitney, at 12,000 feet altitude, *l. c.* 325.

ASTER PULCHELLUS, D. C. Eaton.—Appears to me by its broader and thicker leaves to be distinct from the above (*A. Andersonii*, Gray). Though, as already intimated by Dr. Gray, in Fl. Cal. 1, 325, it is very near it. Southern Sierras, in wet meadows, at 8,200 feet (321).

ERIGERON FOLIOSUM, Nutt., var. STENOPHYLLUM, Gray.—Santa Barbara

(98); also another from near this, but with wider leaves, from Bartlett's Cañon, 12 miles north from Santa Barbara (138), *l. c* 330.

Baccharis Douglasii, DC.—Near Hot Springs, Kern Co. (296), Fl. Cal. 1, 333.

Tessaria borealis, T. & G.—Santa Clara Valley (184), *l. c.* 334.

Gnaphalium palustre, Nutt.—Santa Barbara, *l. c.* 342.

Iva axillaris, Pursh.—Cuddy's Ranch, near Fort Tejon, at 5,150 feet altitude (256), *l. c.* 343.

Viguiera reticulata, Watson.—Telescope Mountain, *l. c.* 354.

Helianthus petiolaris, Nutt.—Head of Peru Creek, *l. c.* 353.

Helianthus Californicus, DC.—Fort Tejon, *l. c.* 353.

Encelia Californica, Nutt.—Santa Barbara (82), *l. c.* 351.

Madia elegàns, Don.—Walker's Basin, at 3,440 feet altitude (293), *l. c.* 359.

Hemizonia ramosissima, Benth.—Santa Barbara (38, 100), and Santa Clara Valley (176), *l. c.* 362.

Hemizonia pungens, T. & G.—Santa Barbara (81), *l. c.* 363.

Hemizonia Wheeleri, Gray.—Southern Sierras, at 8,200 feet altitude (306), *l. c.* 617.—Plate X. Natural size. Fig 1. Vertical section through flower, showing ray- and disk-flowers in place on the convex receptacle. Fig. 2. Ray-flower, with its achenium enfolded by the scale of involucre. Fig. 3. Chaff of disk. Fig. 4. Disk-flower, with abortive ovary. Fig. 5. Top view of the receptacle and scales of the involucre. Fig. 6. Scale of involucre, enfolding ray-achenium. Fig. 7. Ray-achenium. All enlarged about 8 diameters.

Lagophylla ramosissima, Nutt.—Fort Tejon, at 3,150 feet altitude (194), *l. c.* 367.

Jaumea carnosa, Gray.—Santa Barbara, salt-marshes near the coast, *l. c.* 372.

Venegasia carpesioides, DC.—Bartlett's Cañon, near Santa Barbara (142), *l. c.* 372.

Hulsea algida, Gray.—Mount Whitney, at 13,700 feet altitude (387), *l. c.* 386.

Chænactis Douglasii, Hook. & Arn.—Mount Olanche, at 9,400 feet altitude, *l. c.* 391.

Bahia confertiflora, DC.—Santa Barbara (37), *l. c.* 380.

Helenium Bigelovii, Gray.—Soda Spring, North Fork of Kern River, at 8,500 feet (414), *l. c.* 393.

Achillea Millefolium, L.—Head of Peru Creek, *l. c.* 400.

Tanacetum canum, D. C. Eaton.—Olanche Mountain, at 10,000 feet altitude. Hitherto only found on the East Humboldt Mountains, Nevada; *l. c.* 617.

Artemisia Rothrockii, Gray.—Manachi Meadows, 8,200 feet (298). The common sage-brush of the region. A well-marked species of the section *Seriphidium*, Besser, *l. c.* 618.—Plate XIII. Natural size. Fig. 1. Head of flowers, magnified about 8 diameters. Fig. 2. Vertical section through head of flowers, enlarged about 8 diameters. Fig. 3. A single flower, enlarged about 10 diameters. Fig. 4. Style with stigmas, enlarged about 12 diameters.

Artemisia Ludoviciana, Nutt.—Foot of Mount Olanche, at 9,400 feet altitude (338), a variety with large leaves, the lower ones pinnatifid, and the upper ones entire; heads large; *l. c.* 404.

Arnica foliosa, Nutt.—North Fork of Kern River, at 12,000 feet altitude (399), *l. c.* 416.

Senecio triangularis, Hook.—Mounts Olanche and Whitney, from 9,800 to 12,000 feet, *l. c.* 414.

Senecio aureus, L., var., Gray, verging toward *S. canus*.—South Fork of Kern River, at 10,200 feet, on the mountains.

Senecio Douglasii, DC.—Francisquito Pass (180, 181), *l. c.* 411.

Senecio Clarkianus, Gray.—Mountains back of Soda Spring, on North Fork of Kern River, at 8,500 feet altitude (408), *l. c.* 412; a well-marked and striking species.

Senecio Fremontii, T. & G., var. occidentalis, Gray, *l. c.* 618.—I can hardly help thinking we have in this a distinct species.—Mount Whitney, at 12,000 feet, and mountains along South Fork of Kern River, at 9,800 feet and upward, always growing on the most rocky and exposed places. (388, 380, 349.)

Tetradymia canescens, DC.—Manachi Meadows, 8,200 feet altitude (325), *l. c.* 408.

TETRADYMIA SQUAMATA, var. BREWERI, Gray.—Fort Tejon, 5,100 feet (276), *l. c.* 408.

CNICUS OCCIDENTALIS, Gray.—Near Fort Tejon, at 5,100 feet (275), *l. c.* 419.

CNICUS ANDERSONII, Gray.—Base of Mount Whitney, at 11,500 feet, *l. c.* 419.

CENTAUREA MELITENSIS, Linn.—Los Angeles (39), a pest, *l. c.* 421.

HIERACIUM BREWERI, Gray.—Olanche Mountain, at 10,400 feet altitude (329), *l. c.* 440.

MALACOTHRIX TENUIFOLIA, T. & G.—Bartlett's Cañon, near Santa Barbara (122), *l. c.* 434.

STEPHANOMERIA MINOR, Nutt.—South Fork of Kern River, 9,500 feet altitude, *l. c.* 428.

STEPHANOMERIA EXIGUA, Nutt.—Head of Peru Creek, at 5,100 feet, *l. c.* 428.

CAMPANULACEÆ.

PALMERELLA DEBILIS, var. SERRATA, Gray.—Ojai Creek, *l. c.* 619.—PLATE XVI. Natural size. Fig. 1. Flower, enlarged about 5 diameters. Fig. 2. Corolla, opened, showing the united stamens, two of which have anthers that are tipped with a tuft of unequal rigid bristles, enlarged about 5 diameters. Fig. 3. Vertical section through flower, enlarged about 6 diameters. Fig. 4. Cross-section of ovary, enlarged about 6 diameters.

ERICACEÆ.

ARCTOSTAPHYLOS TOMENTOSA, Dougl.—Santa Barbara, *l. c.* p. 452.

ARCTOSTAPHYLOS GLAUCA, Lindl.—Fort Tejon, *l. c.* p. 454.

BRYANTHUS BREWERI, Gray.—Fisherman's Peak, at 12,000 feet, *l. c.* 456.

SARCODES SANGUINEA, Torr.—Mount Piños, at 8,000 feet, *l. c.* 462.*

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* This would be the proper place to call attention to that most remarkable plant described and figured by Dr. Torrey (Ann. Lyc. Nat. Hist. N. York, 1864), AMMOBROMA SONORÆ, Torr., growing near the upper end of the Gulf of California, and much used by the Papago Indians as a food. It is roasted or dried, and, after being ground with the mesquit beans, used as a "pinole." "Simply roasted, it has somewhat the taste of a sweet potato, only far more delicate." It is among the desiderata in our collections.

PRIMULACEÆ.

PRIMULA SUFFRUTESCENS, Gray.—Fisherman's Peak, at 13,000 feet (419), *l. c.* 468.

DODECATHEON MEADIA, L., var. ALPINUM, Watson. Apparently a more luxuriant form, from a lesser altitude than usual. Head of Peru Creek, 5,100 feet (368), *l. c.* 467.

SAMOLUS VALERANDI, L, var. AMERICANUS, Gray.—Santa Barbara (52), *l. c.* 470.

ANAGALLIS ARVENSIS, L.—Santa Barbara, *l. c.* 469.

ASCLEPIADEÆ.

BY DR. GEORGE ENGELMANN.

ASCLEPIAS EROSA, Torr. Bot. Mex. Bound. 162. (*A. leucophylla*, Engelm. Am. Naturalist, 9, 349; Gray, Bot. Calif 1, 476; Syn. 94.)—Fort Tejon.

ASCLEPIAS MEXICANA, Cav. Gray, Proc. Am. Acad. 12, 71; Syn. 96. (*A. fascicularis*, Decaisne in DC. Prod. 8, 469; Gray, Bot. Calif. 1, 475.)—Lake Elizabeth, Rothrock (190), 1875. Very closely allied to *A. verticillata;* the flowers, though a little larger than in the common forms of that species, are scarcely to be distinguished from it. I find, however, the top of the rounded hoods more reflexed, and the horn comes from near the base of the hood, while in *verticillata* it is attached to the whole lower third or half. But *A. Mexicana* is altogether a stouter plant, with spreading, or at last recurved, usually conduplicate leaves, bearing the umbels in a terminal corymb.

GENTIANEÆ.

BY DR. GEORGE ENGELMANN.

GENTIANA SERRATA, Gunn. Fl. Norveg. 10, var. HOLOPETALA, Gray, Fl. Calif. 1, 481; Syn 117.—Simple, or with many simple, ascending branches from the base, and long, naked peduncles; lobes of the corolla entire or with few notches.—Southern Sierras, Kern County, at 10,000 feet altitude. Easily distinguished from *G. simplex*, Gray, by the oval, rough ovules and seeds, while those of the latter species are lanceolate, smooth, and tailed at both ends.

POLEMONIACEÆ.

By Prof. T. C. Porter.

Collomia aggregata, Porter. (*Gilia aggregata*, Spreng.)—Olanche Mountain, at 10,000 feet elevation, September (358), *l. c.* 496.

Gilia densiflora, Benth.—Mount Piños, at 6,000 feet elevation, July (204), *l. c.* 491.

Gilia Californica, Benth.—Little Olanche Mountain, at 9,400 feet, September (339), *l. c.* 492.

Gilia virgata, Steud.—Head of Peru Creek, at 5,000 feet (245), *l. c.* 495.

HYDROPHYLLACEÆ.

Phacelia circinata, Jacq. f.—South Fork of Kern River, at 9,800 feet altitude (336), *l. c.* 1, 506.

Phacelia ramosissima, Dougl.—Fort Tejon, Santa Barbara (112, 95), *l. c.* 1, 508.

Phacelia grandiflora, Gray.—Cassitas Pass, 550 feet altitude (165), *l. c.* 1, 513.

Nama Rothrockii, Gray.—Little Manachi Meadows, 5,000–6,000 feet altitude, *l. c.* 621.—Plate XVIII. Natural size. Fig. 1. Flower. Fig. 2. Corolla, split open. Fig. 3. Pistil and calyx, all enlarged about 4 diameters. Fig. 4. Vertical section of pistil. Fig. 5. Cross-section of ovary, the two latter enlarged about 6 diameters. Fig. 6. Mature seed, enlarged about 5 diameters.

Eriodictyon tomentosum, Benth.—Fort Tejon, 5,100 feet altitude, (277), *l. c.* 518.

CONVOLVULACEÆ.

Cressa Cretica, L.—Santa Barbara, *l. c.* 534.

Cuscuta salina, Engelm.—Santa Barbara, on *Frankenia* and *Salsola* (101).

BORRAGINACEÆ.

By Prof. T. C. Porter.

Heliotropium Curassavicum, Linn.—Fort Tejon, at 3,150 feet elevation, August (260), *l. c.* 521.

Amsinckia spectabilis, Fisch. & Meyer.—Santa Barbara, June (91), *l. c.* 524.

Eritrichium muriculatum, A. DC.?; Torr.—Santa Barbara, June (88), *l. c.* 528.

SOLANACEÆ.

Solanum nigrum, L., var. Douglasii, Gray.—Santa Barbara (83), *l. c.* 538.

Solanum Xanti, Gray.—Bartlett's Cañon, Santa Barbara (131), *l. c.* 539.

Nicotiana attenuata, Torr.—Santa Clara Valley (183) and head of Peru Creek (244), at 5,100 feet elevation, *l. c.* p. 545.

Nicotiana Clevelandi, Gray, Syn. Fl. N. Am. vol. 2, 1, p. 242.—A small-flowered form at Santa Barbara.

SCROPHULARIACEÆ.

By Prof. T. C. Porter.

Scrophularia Californica, Cham.—Bartlett's Cañon, Santa Barbara, July, 1875, Rothrock (118), *l. c.* 552.

Pentstemon Menziesii, Hook.—Olanche Mountain, at 10,400 feet elevation, September, 1875, Rothrock (50, 332), *l. c.* 556.

Pentstemon cordifolius, Benth.—Bartlett's Cañon, Santa Barbara, July, 1875, Rothrock (130), *l. c.* 557.

Pentstemon Rothrockii, Gray (Syn. Fl. N. Am. vol. 2, 1, 261).—Little Olanche Mountain, Kern River, at 10,400 feet elevation, September, 1875, Rothrock (341).

Pentstemon confertus, Dougl., var. cæruleo-purpureus, Gray.—Kern River, at 9,850 feet elevation, and Olanche Mountain, at 10,400 feet elevation, September, 1875, Rothrock (379, 332). Fl. Cal. 560.

PENSTEMON RŒZLI, Regel.—Olanche Mountain, at 10,000 feet elevation, September, 1875, W. L. Kennedy (317), *l. c.* 561.

MIMULUS LEPTALEUS, Gray.—Kern River, at 9,850 feet elevation, September, 1875, Rothrock (378), *l. c.* 564.

MIMULUS GLUTINOSUS, Wendland.—Santa Barbara, July, 1875, Rothrock (11, 12), *l. c.* 565.

MIMULUS CARDINALIS, Dougl.—Bartlett's Cañon, Santa Barbara, July, 1875, Rothrock (156), *l. c.* 566.

MIMULUS LUTEUS, Linn.—Santa Barbara, June, 1875, Rothrock (53), *l. c.* 567.

MIMULUS LUTEUS, L., var. ALPINUS, Gray.—South Fork of Kern River, at 8,200 feet elevation, September, 1875, Rothrock (312).

MIMULUS LUTEUS, L., var. DEPAUPERATUS, Gray.—North Fork of Kern River, at 8,500 feet elevation, September, 1875, Rothrock (409).

MIMULUS RUBELLUS, Gray.—Soda Spring, Kern River, October, 1875, Rothrock (410), *l. c.* 568.

MIMULUS FLORIBUNDUS, Dougl.—Head of Peru Creek, at 5,100 feet elevation, August, 1875, Rothrock (232), *l. c.* 569.

MIMULUS PRIMULOIDES, Benth.—Mount Whitney, at 10,000 feet elevation, September, 1875, Rothrock (393), *l. c.* 569.

CASTILLEIA AFFINIS, Hook. & Arn.—Fort Tejon, at 3,150 feet elevation, July, 1875, Rothrock (194), *l. c.* 573.

CASTILLEIA MINOR, Gray.—Head of Peru Creek, at 5,100 feet elevation, August, 1875, Rothrock (236), *l. c.* 573.

CASTILLEIA PARVIFLORA, Bongard.—Olanche Mountain, at 10,000 feet elevation, September, 1875, Rothrock (333), *l c.* 574.

CASTILLEIA MINIATA, Dougl.—Mount Whitney, September, 1875, Rothrock (49), *l. c.* 574.

CORDYLANTHUS FILIFOLIUS, Nutt., var. BREVIBRACTEATUS, Gray.—Soda Spring, Kern County, at 8,500 feet elevation, September, 1875, Rothrock (422), *l. c.* 581.

VERBENACEÆ.

VERBENA BRACTEOSA, Michx.—Santa Barbara (92), Fl. Cal. 1, 609.

LABIATÆ.

By Prof. T. C. Porter.

Mentha Canadensis, Linn.—Walker's Basin, at 3,440 feet elevation, September, 1875, Rothrock (282), *l. c.* 591.

Monardella villosa, Benth.—Kern River, at 10,000 feet elevation, September, 1875, Rothrock (316), *l. c.* 593.

Monardella villosa, var. glabella, Gray.—Mount Whitney, September, 1875, Rothrock (42), *l. c.* 593.

Monardella odoratissima, Benth.—Mount Piños, at 7,000 feet elevation, July, 1875, Rothrock (207), *l. c.* 594.

Monardella lanceolata, Gray.—Ojai Creek Valley, July, 1875, Rothrock (175), *l. c.* 594.

Micromeria Douglasii, Benth.—Cassitas Pass, at 525 feet elevation, July, 1875, Rothrock (166), *l. c.* 595.

Sphacele calycina, Benth.—Bartlett's Cañon, Santa Barbara, July, 1875, Rothrock (136), *l. c.* 598.

Salvia Columbariæ, Benth.—Cuddy's Ranch, near Fort Tejon, July, 1875, Rothrock (203), *l. c.* 599. "Chia."

Audibertia grandiflora, Benth.—Bartlett's Cañon, Santa Barbara, July, 1875, Rothrock (137), *l. c.* 600.

Audibertia nivea, Benth.—Santa Barbara, July, 1875, Rothrock (4), *l. c.* 601.

Stachys ajugoides, Benth.—Santa Barbara, July, 1875, Rothrock (157), *l c.* 605.

Stachys albens, Gray.—Head of Santa Clara Valley, July, 1875, Rothrock (182), *l. c.* 605.

Stachys bullata, Benth.—Santa Barbara, June, 1875, Rothrock (87), *l. c.* 606.

POLYGONACEÆ.

By Prof. T. C. Porter.

Eriogonum stellatum, Benth. (*E. polyanthum*, Benth.)—Cuddy's Ranch, near Fort Tejon, July, 1875, Rothrock (199).

Eriogonum ovalifolium, Nutt.—Mount Whitney, at 12,000 feet elevation, September, 1875, Rothrock (390).

ERIOGONUM KENNEDYI, Porter (Watson, Proc. Am. Acad. 12, p. 263).—Mount Piños, 1876, W. L. Kennedy.

ERIOGONUM NUDUM, Dougl., var. PAUCIFLORUM, Watson.—Head of Peru Creek, at 5,150 feet elevation, August, 1875, Rothrock (220).

ERIOGONUM FASCICULATUM, Benth.—Bartlett's Cañon, Santa Barbara, June, 1875 (123), and Camulas Ranch, at 525 feet elevation, July, 1875, Rothrock (179).

ERIOGONUM FASCICULATUM, Benth., var. POLIFOLIUM, Gray.—Cuddy's Ranch, near Fort Tejon, at 5,150 feet elevation, August, 1875, Rothrock (202).

ERIOGONUM BAILEYI, Watson (Proc. Am. Acad. 10, p. 348).—Head of Peru Creek, at 5,150 feet elevation, July, 1875, Rothrock (219).

ERIOGONUM WRIGHTII, Torr.—Reduced forms. Mount Piños, July and August, 1875, Rothrock (210, 269).

ERIOGONUM VIRGATUM, Benth.—Fort Tejon, at 3,150 feet elevation, August, 1875, Rothrock (259).

ERIOGONUM SPERGULINUM, Gray.—Olanche Mountain, at 9,400 feet elevation, July, 1875, Rothrock (331).

CHORIZANTHE MEMBRANACEA, Benth.—Kern County, 1876, W. L. Kennedy.

CHORIZANTHE STATICOIDES, Benth.—Cassitas Pass, at 550 feet elevation, July, 1875, Rothrock (168).

CHORIZANTHE WHEELERI, Watson (Proc. Am. Acad. 12, p. 272).—Santa Barbara, July, 1875, Rothrock (62).

CHORIZANTHE THURBERI, Gray. (*Centrostegia*, Gray, in DC. Prod. 14, p. 27.)—Cuddy's Ranch, near Fort Tejon, at 5,150 feet elevation, August, 1875, Rothrock (273).

RUMEX CONGLOMERATUS, Murray.—Santa Barbara, July, 1875, Rothrock (64). Introduced.

POLYGONUM AVICULARE, Linn.—California, July, 1875, Rothrock (63).

CHENOPODIACEÆ.

CHENOPODIUM ALBUM, L.—Over the State.

SALICORNIA AMBIGUA, Michx.—Santa Barbara, in the salt-marshes.

URTICEÆ.

URTICA HOLOSERICEA, Nutt.—Santa Barbara (162).

SALICACEÆ.

SALIX LÆVIGATA, Bebb, var. ANGUSTIFOLIA? (Fl. Cal. ined.).—Lake Elizabeth, July, 3,170 feet altitude. Fertile aments too old for satisfactory determination.

SALIX GLAUCA, L. (Watson, vol. v, King's Rep. p. 325.)—Base of Mount Whitney, 11,500 feet altitude (406).

EUPHORBIACEÆ.

BY DR. GEORGE ENGELMANN.

CROTON CALIFORNICUS, Müll., var. MAJOR, Watson, Fl. Cal. vol. 2, ined. (*Hendecandra procumbens*, Eschsch.)—Erect, stouter than the type of the species; leaves oval-oblong, 2′ long, on petioles 6″ long. Sandy coast at Santa Barbara (113). Previously found by Nuttall.

EREMOCARPUS SETIGERUS, Benth. Bot. Sulph. 53, tab. 26; DC. Prod. 15, pars. 2, 708.—Sandy seashore of Southern California, Rothrock, at Santa Barbara.

EUPHORBIA (ANISOPHYLLUM) ALBOMARGINATA, Torr. & Gray in Pacif. R. R. Rep. 2, 174, Bot. Mex. Bound. 186; Boissier in DC. Prod. 15, 2, 30.—Fort Tejon (274).

CUPULIFERÆ.

BY DR. GEORGE ENGELMANN.

QUERCUS LOBATA, Née.—Fort Tejon, at over 3,000 feet altitude (198).

QUERCUS DUMOSA, Nutt., Engelm. Trans. St. Louis Acad. 3, 382 and 393.—Francisquita Cañon, at 2,100 feet altitude. A form with large, sessile acorns; cups with small, brown, downy scales, only slightly tumid at base.

QUERCUS CHRYSOLEPIS, Liebm.—The specimen collected at Fort Tejon is from a large tree, with large acorns, in thickly fulvous-tomentose cups, but with small (1′ long) entire leaves.

QUERCUS AGRIFOLIA, Née.—A large tree common about Santa Barbara (163, 164).

QUERCUS SONOMENSIS, Benth.—On Mount Piños (205).

CASTANEA CHRYSOLEPIS, Hook.—A shrub 4° high. On Olanche Mountain, at from 8–10,000 feet altitude (344).

LORANTHACEÆ.

BY DR. GEORGE ENGELMANN.

ARCEUTHOBIUM OCCIDENTALE, Engelm., in Brewer & Watson's Fl. Cal. vol. 2, ined.—On *Pinus Sabiana* in Walker's Basin, Rothrock (429), in 1875. Dr. Rothrock gives quite a graphic account of the shower of seeds expelled from the berries to the distance of ten feet, when on November 12th he shook a limb on which the parasite grew. Also collected on Mount Piños, on a form of *Pinus ponderosa.*

SAURUREÆ.

ANEMOPSIS CALIFORNICA, Hook.—Santa Barbara (3).

CONIFERÆ.

BY DR. GEORGE ENGELMANN.

PINUS MONOPHYLLOS, Torr. & Fremont.—Common at middle altitudes.

PINUS BALFOURIANA, Murr., var.—Was found on Mount Whitney (404). By its leaves in fives, with loose, deciduous sheaths, entire margins, and peripheral (generally 2 dorsal) ducts, this species is closely allied to *P. flexilis*, and still more to the *Cembroides*, but the small, large-winged seeds distinguish it from them. The smoothness of the leaf-edges is a feature peculiar to a geographical group of Pines, otherwise pretty distinct; we find it always accompanied by deciduous sheaths, but many other species with deciduous sheaths have serrulate leaves.

PINUS SABINIANA, Dougl.—Walker's Basin, at 3,300 feet altitude.

JUNIPERUS CALIFORNICA, Carr.—A large shrub or small tree with thick branchlets; leaves mostly in threes, with minutely fringed edges; berries mostly oval, 5–6″ long, glaucous-reddish, dry and sweetish, with one or sometimes two large seeds; cotyledons about 5.—Conif 58; Engelm. Junip. 588. Kern River, at 9,800 feet altitude, Rothrock (337), 1875. The specimen is a small leaf-branch only, without fruit, so that the name may be

doubtful. I have never seen it from such high altitudes, which are generally occupied by *Juniperus occidentalis*. The species is distinguished from every other *Juniperus* by the larger number of cotyledons, the others having only two.

LIBOCEDRUS DECURRENS, Torr.—North Fork of Kern River (423).

ORCHIDEÆ.

EPIPACTIS GIGANTEA, Dougl.—Bartlett's Cañon, Santa Barbara (117).

JUNCEÆ.

BY DR. GEORGE ENGELMANN.

JUNCUS ACUTUS, Linn., var. SPHÆROCARPUS, Engelm.—Near the sea-coast, Santa Barbara (102).—Mr. Watson has directed attention to the fact that this form has a more elongated, stricter panicle, with smaller, subglobose capsules, and seeds with shorter appendages. I find the same in the South American specimens, and in those of Cape of Good Hope. The name of *J. macrocarpus*, which Nees has given to this latter, would not be appropriate for this form, as the capsules are actually smaller than in the Mediterranean plant. I cannot consider these slight differences as of specific value, as we find the like in several other species of this genus.

JUNCUS DUBIUS, Engelm. Junc. 459.—Walker's Basin, at 3,300 feet (287).

LILIACEÆ.

YUCCA WHIPPLEI, Torr.—Santa Barbara (135).

CYPERACEÆ.

ELEOCHARIS PALUSTRIS, R. Br.—Santa Barbara (58).

ELEOCHARIS ACICULARIS, R. Br.—Santa Barbara (80).

SCIRPUS VALIDUS, Vahl.—Santa Barbara (57). Walker's Basin, at 3,440 feet (286). This is the well-known Tule of California, forming dense masses along lake and river shores, from 4 to 10° high.

SCIRPUS MICROCARPUS, Presl.—Santa Barbara (150).

SCIRPUS MARITIMUS, L.—Santa Barbara (104).

FIMBRISTYLIS THERMALIS, Watson.—Hot springs, near Kernville, growing in water at 128° Fahr. Specimens frequently found with as many as seven spikes in an umbel (303).

CAREX VULGARIS, Fries, var. HYPERBOREA, Boott. (*C. hyperborea*, Drej.)—4–8′ high, scabrous above and sharply angled; leaves 3″ wide, erect, shorter than the culm. Male spikes 1–2; female spikes 3, the lowest long-peduncled and loosely flowered at base; perigynia ovate, nerveless, purple at top, ciliate at the entire orifice and on the upper margin, as long as, or shorter than the lanceolate purple scale; bracts of the lower female spike setaceous. Very scabrous, with large purple auricles.—Kern River, 9,800 feet elevation (371).

GRAMINEÆ.

BY DR. GEORGE VASEY.

VILFA DEPAUPERATA, Torr. (Watson's Botany of 40th Parallel).—North Fork of Kern River, 1875 (377); apparently the same as Bolander's No. 6092 and *Sporobolus nodosus*, Nutt.

VILFA DEPAUPERATA, Torr., var. FILIFORMIS, Watson.—Olanche Mountain, 9,400 feet altitude, 1875 (348).

AGROSTIS EXARATA, Trin.—Head of Kern River, 1875 (231).

AGROSTIS EXARATA, Trin., var. MICROPHYLLA. (*A. microphylla*, Steud.)—Head of Kern River, 1875 (249). It seems difficult to regard this as only a variety.

AGROSTIS VARIANS, Trin.—Collected along Kern River, 1875 (323).

MELICA IMPERFECTA, Trin.—Santa Barbara, 1875 (148). The var. SESQUIFLORA, Bol.

GLYCERIA PAUCIFLORA, Presl (Watson's Bot. of 40th Parallel, Synopsis Flora of Colorado).—Utah, 1871 and 1872; Kern River, 1875 (385).

BRIZOPYRUM SPICATUM, Hook., var. STRICTUM.—1875 (427).

ELYMUS SITANION, Schultz (Watson's Bot. 40th Parallel, Synopsis Flora of Colorado).—Mount Whitney, 1875 (403).

ELYMUS CONDENSATUS, Presl (Watson's Bot. 40th Parallel, Synopsis Flora of Colorado).—Santa Barbara, 1875 (134).

ELYMUS TRITICOIDES, Nutt.—Fort Tejon, 1875 (192). Head of Peru Creek, 1875 (238).

TRISETUM SUBSPICATUM, Beauv.—Mount Whitney, 1875 (390).

AIRA CÆSPITOSA, L., var. MONTANA.—Kern River, 1875 (379, 392).

AIRA ELONGATA, Hook.—Olanche Mountain, 1875 (342).

PASPALUM DISTICHUM, L.—1875 (59).

For an account of the FILICES collected by the Expedition in California, see paper by Prof. D. C. Eaton, in the main report.

TABLE OF ORDERS.

SHOWING ALSO THE NUMBER OF THEIR GENERA AND SPECIES.

Orders.	Genera.	Species.	Orders.	Genera.	Species.	Orders.	Genera.	Species.
Ranunculaceæ	12	36	Loaseæ	3	8	Amarantaceæ	6	11
Berberideæ	1	4	Cucurbitaceæ	3	3	Chenopodieæ	11	23
Papaveraceæ	4	4	Datisceæ	1	1	Paronychieæ	1	1
Cruciferæ	18	43	Cacteæ	4	16	Elæagneæ	2	2
Capparideæ	4	10	Ficoideæ	2	2	Urticeæ	2	5
Cistineæ	1	1	Umbelliferæ	15	19	Betulaceæ	2	4
Violaceæ	1	4	Cornaceæ	2	2	Plataneæ	1	1
Bixineæ	1	1	Caprifoliaceæ	5	8	Salicaceæ	2	13
Polygaleæ	3	4	Rubiaceæ	3	6	Euphorbiaceæ	5	16
Frankeniaceæ	1	1	Valerianaceæ	2	3	Saurureæ	1	1
Caryophylleæ	8	25	Compositæ	93	255	Juglandaceæ	1	1
Portulacaceæ	5	9	Campanulaceæ	4	7	Cupuliferæ	2	10
Elatineæ	1	1	Ericaceæ	8	14	Loranthaceæ	2	8
Tamariscineæ	1	1	Primulaceæ	6	9	Santalaceæ	1	2
Hypericineæ	1	1	Oleaceæ	3	7	Coniferæ	6	18
Malvaceæ	7	15	Apocynaceæ	2	3	Gnetaceæ	1	2
Sterculiaceæ	2	2	Asclepiadeæ	3	10	Orchideæ	6	8
Lineæ	1	3	Gentianeæ	6	15	Irideæ	2	4
Malpighiaceæ	1	1	Polemoniaceæ	4	27	Amaryllideæ	1	3
Zygophyllaceæ	2	3	Hydrophyllaceæ	6	12	Alismaceæ	1	2
Geraniaceæ	3	5	Borraginaceæ	8	21	Naiadeæ	2	5
Rutaceæ	2	2	Convolvulaceæ	4	12	Typhaceæ	1	2
Celastrineæ	1	1	Cuscuteæ	2	3	Liliaceæ	13	23
Rhamneæ	4	7	Solanaceæ	6	17	Xerotideæ	1	2
Ampelideæ	2	3	Scrophulariaceæ	18	73	Junceæ	1	12
Sapindaceæ	4	6	Orobanchaceæ	2	2	Commelyneæ	1	1
Anacardiaceæ	1	5	Bignoniaceæ	2	3	Cyperaceæ	9	59
Leguminosæ	36	126	Acanthaceæ	1	1	Gramineæ	47	120
Rosaceæ	22	44	Verbenaceæ	2	5	Filices	16	66
Saxifrageæ	7	22	Labiatæ	21	34	Ophioglosseæ	2	6
Crassulaceæ	3	6	Plantagineæ	1	2	Musci	42	79
Haloragieæ	2	3	Nyctagineæ	5	16	Hepaticæ	5	15
Lythrarieæ	2	2	Phytolaccæ	1	1	Lichenes	16	28
Onagrarieæ	7	37	Polygonaceæ	6	49			

This table shows the catalogue and appendix combined, to enumerate or describe 104 Orders, 637 Genera, and 1,657 Species. Pending the arrangement by Bentham and Hooker, I have in some instances (as in Liliaceæ) grouped plants more with regard to present convenience than to the orders they will ultimately be placed in; a fault of no great importance in a work like the present.

In the above table are counted only well-recognized species. Besides these, however, the volume contains a large number of varieties more or less clearly separable from the species to which they are referred. Many of these doubtless will yet be recognized as distinct. As a rule, only the plants collected by the various parties of this Survey have been enumerated or described in this Report. In the masterly contribution on the Ferns alone has this rule been widely departed from. In it the species enumerated outside of those collected by the Survey are not enough to greatly affect the above table.

Though somewhat out of place here, I add information received from Mr. Watson relative to *Dasylirion graminifolium*, Zucc. (numbers 329 655, described on page 272, as the body of the text was stereotyped before the information was received, and as, further, there appears to be some doubt as to the practicability of finding a more suitable place among "addenda et corrigenda." In 1871, Mr. Bischoff of this Survey collected and sent home seeds of this species. From these, plants have been raised, and are now growing in the Cambridge Botanic Garden. After a careful study of the living and the dried specimens, Mr. Watson decides that it is a new species and proposes for it the name of *Dasylirion Wheeleri*. He states that it differs from *D. graminifolium* Zucc., "in the longer pendant racemes, the wings of the fruit adnate only to the base of the style and prolonged above it, and apparently also by somewhat broader leaves."

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DESCRIPTION OF PLATES.

FRONTISPIECE.

CACTUS GROVE IN ARIZONA (CEREUS GIGANTEUS, Engelm.).

PLATE I.

CANOTIA HOLACANTHA, Torr.—Branch natural size. Fig. 1. Cross-section of flower. Fig. 2. Open flower. Fig. 3. Vertical section of flower. Fig. 4. Inside view of stamen. Fig. 5. Outside view of stamen. Fig. 6. Flower with petals gone, but filaments persisting. Fig. 7. Vertical section through young ovary. Fig. 8. Ovule. Fig. 9. Vertical section through mature ovary. Fig. 10. Cross-section through ovary. Fig. 11. Seed. Fig. 12. Diagonal section through seed. Enlarged 4–5 diameters.

PLATE II.

A. PARRYELLA FILIFOLIA, T. & G.—Branch natural size. Fig. 1. Flower. Fig. 2. Vertical section through flower. Fig. 3. Tube of stamens, laid open. Figs. 1, 2, and 3 enlarged 10 diameters. Fig. 4. Mature legume. Fig. 5. Longitudinal section through Fig. 4, and both enlarged 5 diameters.

B. PETALOSTEMON TENUIFOLIUS, Gray.—Somewhat reduced. Fig. 6. Bract. Fig. 7. Flower. Fig. 8. Flower seen from above, with the four petals on the column of stamens and the fifth on the calyx. Fig. 9. Section through the pod. All enlarged about 10 diameters.

PLATE III.

A. HORKELIA PURPURASCENS, Watson.—Natural size. Fig. 1. Flower-bud. Fig. 2. Expanded flower. Fig. 3. Calyx, spread open. All enlarged about 4 diameters.

B. POTENTILLA WHEELERI, Watson.—Somewhat reduced. Fig. 4. Flower, seen from above. Fig. 5. Flower, seen from below. Fig. 6. Vertical section through flower. All enlarged about 5 diameters. Fig. 7. Single pistil, enlarged about 10 diameters.

PLATE IV.

PETALONYX NITIDUS, Watson.—Fig. 1. Branch natural size. Fig. 2. Flower. Fig. 3. Petal. Fig. 4. Diagonal section through calyx and ovary, showing the single suspended ovule. All enlarged.

Fig. 6. Branch of VIGUIERA RETICULATA, Watson.—Natural size. Fig. 7. Disk-flower, enlarged 20 times. Fig. 8. Chaff of disk-flower, enlarged 20 times. Fig. 9. Ray-flower, enlarged 20 times. Fig. 10. Section through naked receptacle, enlarged 10 times.

PLATE V.

BRICKELLIA LONGIFOLIA, Watson.—Branch nearly natural size. Fig. 1. Head of flowers, enlarged 8–10 times. Fig. 2. Single flower, enlarged 12 times. Fig. 3. Style and stigma, enlarged 12 times. Fig. 4. Receptacle and involucre, enlarged 12 times. Fig. 5. Achenium and pappus, enlarged 12 diamters. Fig. 6. Single bristle of pappus, enlarged 20 times.

PLATE VI.

APLOPAPPUS CERVINUS, Watson.—Fig. 1. Branch natural size. Fig. 2. Inner scale of involucre. Fig. 3. Outer scale of involucre. Fig. 4. Disk-flower. Fig. 5. Style and stigma. Fig. 6. Anther. All enlarged except the branch.

PLATE VII.

A. TOWNSENDIA ROTHROCKII, Gray.—Natural size. Fig. 1. Inner scale of involucre. Fig. 2. Ray-flower. Fig. 3. Ray-flower, style, and stigma. Fig. 4. Portion of pappus of ray-flower, enlarged 25 times. Fig. 5. Disk-flower. Fig. 6. Cross-section of achenium. Fig. 7. Style and stigma of disk-flower. Fig. 8. Bristle from ray-flower pappus. All 10 diameters, except when otherwise stated.

B. ASTER COLORADOENSIS, Gray.—Natural size. Fig. 9. Ray-flower. Fig. 10. Ray-flower style and stigma. Fig. 11. Disk-flower. Fig. 12. Disk-flower style and stigma. Fig. 13. Achenium and pappus of disk-flower. Enlarged about 10 times.

PLATE VIII.

ACTINOMERIS WRIGHTII, Gray.—Branches natural size. Fig. 1. Ray-flower. Fig. 2. Disk-flower and subtending chaff. Fig. 3. Disk-corolla, with style protruding. (Figs. 1, 2, and 3 enlarged about 4 times.) Fig. 4. Style and stigma, 10 diameters. Fig. 5. Mature achenium, enlarged 15 times.

PLATE IX.

WYETHIA ARIZONICA, Gray.—Branch natural size. Fig. 1. Section through receptacle, showing ray-flower and disk-flower in position, the latter subtended by its chaff; somewhat enlarged. Fig. 2. Chaff of disk-flower. Fig. 3. Disk-flower. Fig. 4. Style and stigma of disk-flower. Fig. 5. Mature achenium of disk-flower. Fig. 6. Style and stigma of ray-flower. Fig. 7. Mature achenium of ray-flower. All 10 diameters, unless otherwise stated.

PLATE X.

HEMIZONIA WHEELERI, Gray.—Natural size. Fig. 1. Vertical section through receptacle, showing ray- and disk-flowers in position. Fig. 2. Ray-flower, with its achenium enclosed by scale of involucre. Fig. 3. Chaff of disk. Fig. 4. Disk-flower with abortive ovary. Fig. 5. Top view of receptacle, showing also scales of the involucre. Fig. 6. Scale of involucre enclosing ray-achenium. Fig. 7. Mature ray-flower achenium.

PLATE XI.

LAPHAMIA MEGALOCEPHALA, Watson.—Fig. 1. Branch natural size. Fig. 2. Single flower. Fig. 3. Style and stigma. Fig. 4. —. Fig. 5. Stamen. All enlarged about 10 times.

PLATE XII.

LEUCAMPYX NEWBERRYI, Gray.—Natural size. Fig. 1. Vertical section through the receptacle, showing ray-and disk-flowers; also involucral scale and embracing chaff. Fig. 2. Single scale of involucre. Fig. 3. Ray-flower. Fig. 4. Chaff of the receptacle. Fig. 5. Disk-flower. Fig. 6. Style and stigma of disk-flower. All except the branch enlarged about 7 times.

PLATE XIII.

ARTEMISIA ROTHROCKII, Gray.—Natural size. Fig. 1. Head of flowers. Fig. 2. Section through the same. Both enlarged about 12 times. Fig. 3. A single flower. Fig. 4. Style and stigma.

PLATE XIV.

PYRRHOPAPPUS ROTHROCKII, Gray.—Natural size. Fig. 1. Flower, enlarged 5 times. Fig. 2. Style and stigma, enlarged about 15 times. Fig. 3. Young head closed, enlarged about 3 times. Fig. 4. Achenium and pappus, enlarged about 5 diameters. Fig. 5. Involucre reflexed, showing markings on the convex receptacle, enlarged about 4 times.

PLATE XV.

CHÆTADELPHA WHEELERI, Gray.—Branch natural size. Fig. 1. Involucre, enlarged about 4 times. Fig. 2. Single flower, about 5 diameters. Fig. 3. Style and opened anther-tube, enlarged 10 times. Fig. 4. Mature achenium and pappus, enlarged about 4 diameters. Fig. 5. A branching bristle of the pappus, enlarged about 10 diameters.

PLATE XVI.

PALMERELLA DEBILIS, var. SERRATA, Gray.—Natural size. Fig. 1. Single flower. Fig. 2. Flower, split open, showing the adnate filaments and united anthers, two of which are bristle-tufted at the apex. Fig. 3. Vertical section through flower. Fig. 4. Cross-section through ovary, showing ovules on the central placenta.

PLATE XVII.

HEDEOMA HYSSOPIFOLIA, Gray.—Natural size. Fig. 1. Flower. Fig. 2. Vertical section through flower. Fig. 3. Calyx. Fig. 4. Corolla, opened longitudinally, showing nutlets, style, two perfect and two rudimentary stamens. All enlarged 5 diameters.

PLATE XVIII.

NAMA ROTHROCKII, Gray.—Natural size. Fig. 1. Single flower. Fig. 2. Corolla, laid open, showing stamens. Fig. 3. Calyx, enclosing pistil. Fig. 4. Vertical section through ovary. Fig. 5. Cross-section through ovary. Fig. 6. Seed. All enlarged.

PLATE XIX.

A. GILIA DEBILIS, Watson.—Natural size. Fig. 1. Flower. Fig. 2. Corolla, split open. Enlarged about 5 diameters.

B. GILIA DEMISSA, Gray.—Natural size.

PLATE XX.

CONVOLVULUS LONGIPES, Watson.—Fig. 1. Natural size. Fig. 2. Pistil. Fig. 3. Cross-section of ovary. Fig. 4. Stamen. Figs. 2, 3, and 4 enlarged.

PLATE XXI.

HALENIA ROTHROCKII, Gray.—Natural size. Fig. 1. Flower, enlarged about 5 diameters. Fig. 2. Cross-section of capsule, enlarged about 5 diameters. Fig. 3. Vertical section through flower, enlarged about 10 diameters.

PLATE XXII.

FRAXINUS CORIACEA, Watson.—Fruiting branch, natural size.

PLATE XXIII.

ABRONIA VILLOSA, Watson.—Fig. 1. Branch, natural size. Fig. 2. Flower laid open, enlarged about 5 diameters. Fig. 3. Cross-section of fruit.

PLATE XXIV.

ATRIPLEX WOLFII, Watson.—Natural size. Fig. 1. Staminate flower, enlarged 12–15 diameters. Fig. 2. Pistillate flower, enlarged about 10 diameters. Fig. 3. Pistil, enlarged about 10 diameters. Fig. 4. Vertical section through Fig. 2. Figs. 5. Mature fruit; 6. Vertical section of the same; 7. Its annular embryo, all enlarged about 10 times.

PLATE XXV.

URTICA BREWERI, Watson.—Natural size. Fig. 1. Staminate flower. Fig. 2. Pistillate flower. Fig. 3. Achenium, enclosed by the large inner sepals. Fig. 4. Calyx, opened, showing mature achenium. All enlarged about 10 diameters.

PLATE XXVI.

SISYRINCHIUM ARIZONICUM, Rothr.—Natural size. Fig. 1. Stamen, seen from outside. Fig. 2. Stamen, seen from inside. Fig. 3. Styles and stigmas. Fig. 4. Flower, divested of perianth. Fig. 5. Capsule. All enlarged.

PLATE XXVII.

TRISETUM WOLFII, Vasey.—Fig. 1. Plant, natural size. Fig. 2. Spikelet, enlarged 5 times. Fig. 3. Floret, showing the palets and linear seed.

TRISETUM ALPESTRE, Beauv.—Fig. 4. Natural size. Fig. 5. Spikelet, magnified 6 diameters. Fig. 6. Spikelet, with glumes removed. The last should have shown a little pubescence on the stem of the upper floret.

VILFA MINIMA, Vasey.—Fig. 7. Natural size. Fig. 8. Flower, enlarged 15 times. Fig. 9. Section of stem, greatly enlarged.

PLATE XXVIII.

POA WHEELERI, Vasey.—Fig. 1. Plant, natural size. Fig. 2. Spikelet, magnified 5 times. Fig. 3. Upper floret, with rudiment, enlarged 9 times.

PLATE XXIX.

FESTUCA THURBERI, Vasey.—Natural size. Fig. 1. Spikelet, enlarged 5 times. Fig. 2. Upper glume. Fig. 3. Lower glume. Fig. 4. Upper palet. Fig. 5. Lower palet.

PLATE XXX.

NOTHOLÆNA HOOKERI.—Ordinary size. Fig. 1. Scale of the rootstock. Fig. 2. Scale from the base of the stalk. Fig. 3. Segment of one of the pinnæ, showing the sporangia and the slightly recurved margin. The details are enlarged about 6 diameters.

B. PETALOSTEMON TENUIFOLIUS.

W. H. Seaman, Del.

Figs. 1-5 PETALONYX NITIDUS.

Sprague Del.

A TOWNSENDIA ROTHROCKII. B ASTER COLORADOENSIS.

Sprague, Del.

HEMIZONIA WHEELERI.

W H Seaman, Del.

Figs. 3-4 LAPHAMIA MEGALOCEPHALA

Sprague, Del.

LEUCAMPYX NEWBERRYI.

Sprague, Del.

PALMERELLA DEBLIS VAR. SERRATA.

NAMA ROTHROC

2
1
3
5
4
6

FRAXINUS CORIACEA

W. H. Seaman, Del.

ABRONIA VILLOSA.

ARTIPLEX WILLD.

URTICA BREWERI.

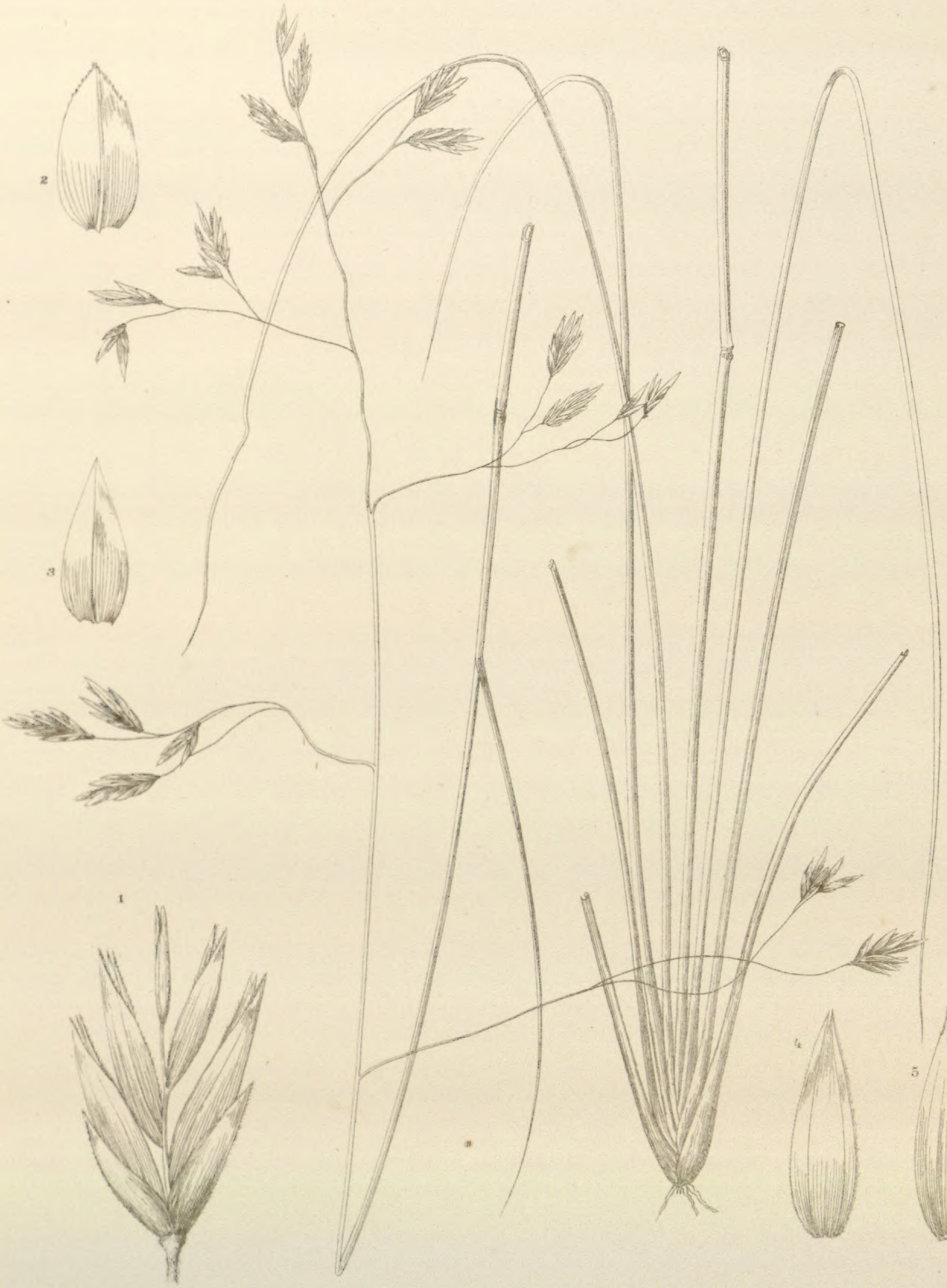
5

W. H. Searman, Del.

Figs. 1-3 TRISETUM WOLFII. Figs. 4-6 TRISETUM ALPESTRE. Figs. 7-9 VILFA MINIMA.

W. H. Seaman. Del.

POA WHEELERI.



W.H. Seaman, Del.

FESTUCA THURBERI.

Sprague. Del.

NOTHOLÆNA HOOKERI